



International Institute for  
Applied Systems Analysis  
[www.iiasa.ac.at](http://www.iiasa.ac.at)

science for global insight

# IIASA's research on risk and foresight

JoAnne Linnerooth-Bayer

Margaret Goud Collins

Leena Ilmola-Sheppard



IIASA, International Institute for Applied Systems Analysis

# Early risk highlights at IIASA

- 1978 Public acceptability of nuclear power; Otway et al.
- 1983 LNG siting controversies; Kunreuther, et al.
- 1986 Hazardous Waste Policy; Wynne et al.
- 1992 Risk and Fairness; Schelling, Thompson, Raiffa, Linnerooth
- 1999 Human Choice and Climate Change; Douglas, Rayner, et al.

# Four short policy stories and the IIASA science behind them

- Global
- Regional
- National
- Local

+ an emerging policy story

# Global policy story

## *Safety nets for vulnerable countries exposed to climate extremes*

IIASA played a key role in a climate risk pooling proposal that became part of the UNFCCC COP16 negotiating text



IIASA developed the concept of a financial mechanism with 2 layers

Which countries are the most vulnerable to weather extremes?

What is the necessary capitalization of a facility that would reinsure governments of these countries?

like index-based weather insurance and sovereign catastrophe bonds.

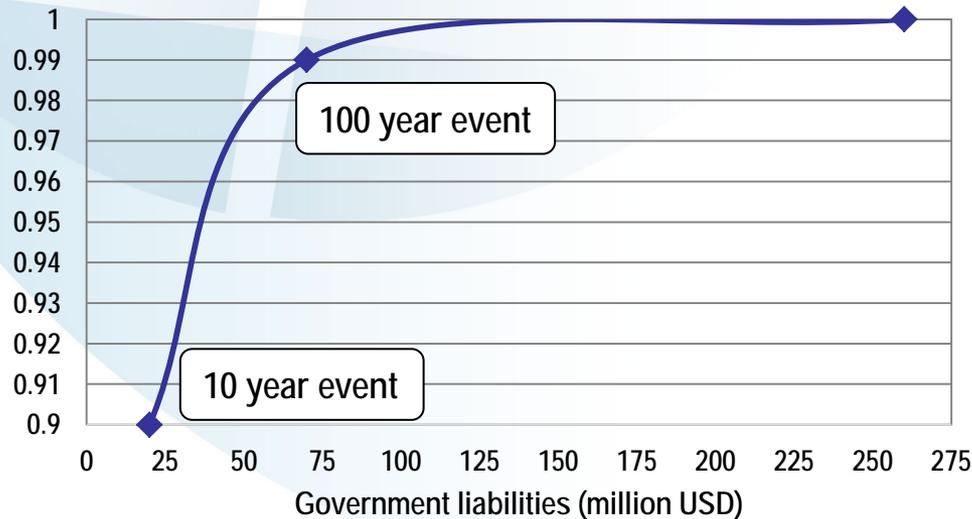
# Global policy story: Safety nets for climate extremes

## *The Science – The CATSIM model*

Probabilistic estimate of public sector losses

Government's post-disaster financing ability

Probability of losses not exceeding a certain level



Diversion from budget

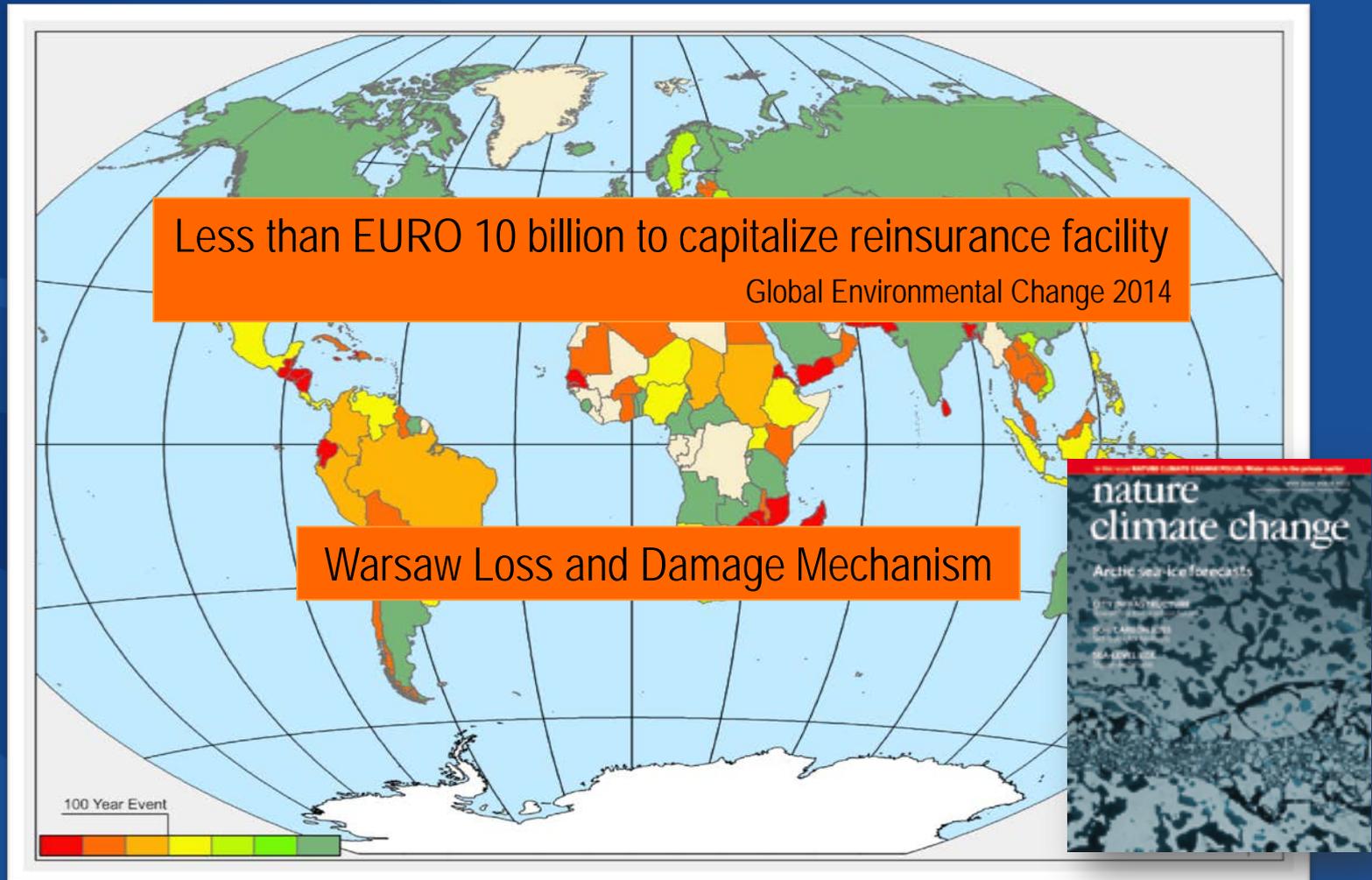
Reserve fund

Domestic bonds and credit

Et cetera

# Global policy story

*Which countries are most vulnerable to weather extremes?*



Mechler, et al. 2010; Hochrainer et al. 2012 World Development Report

# Regional policy story

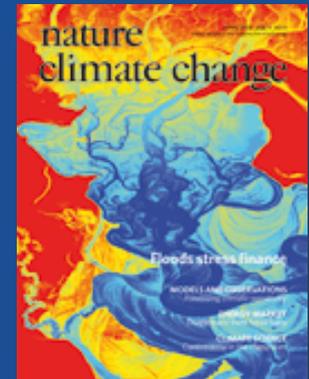
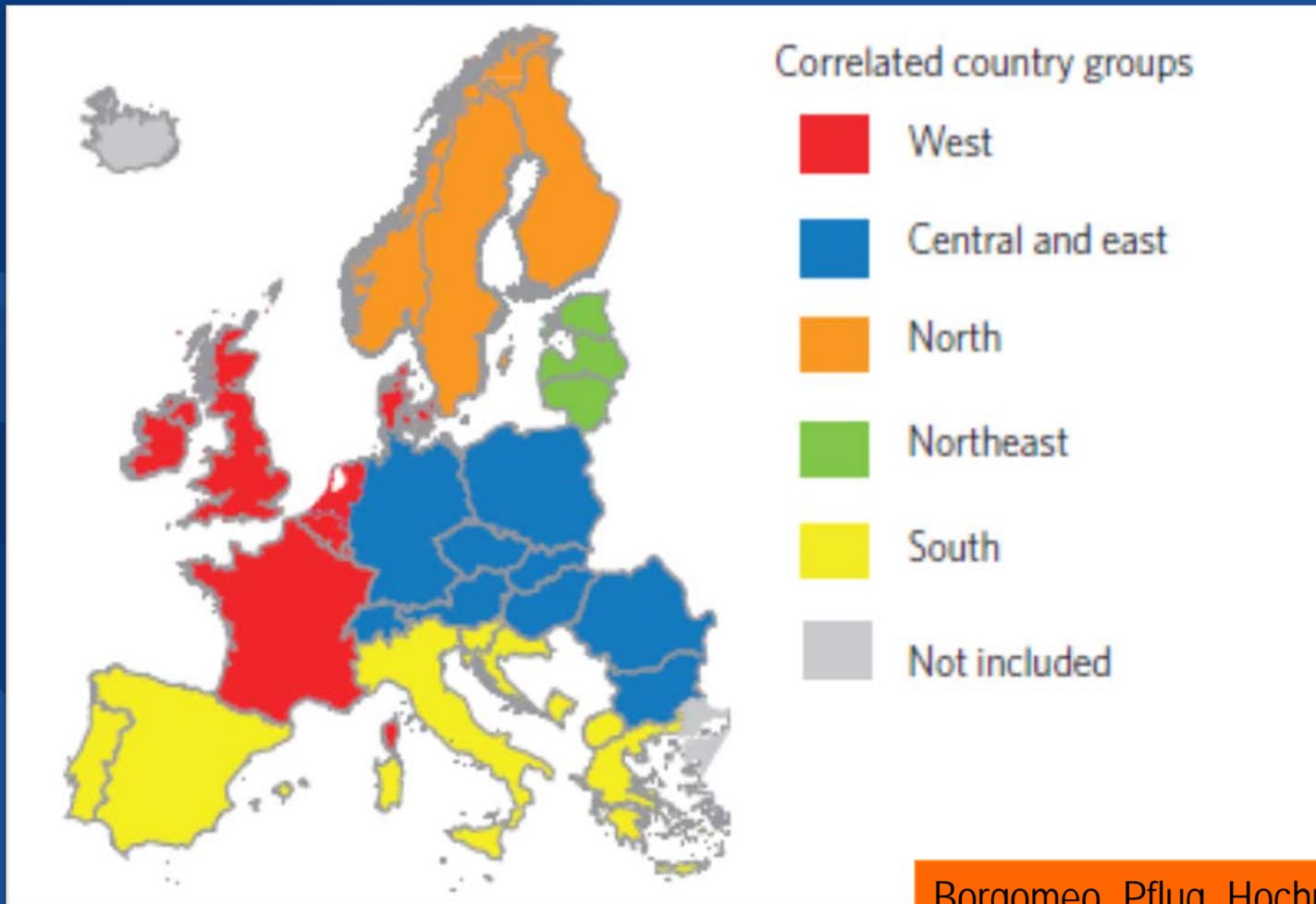
## *Climate change and flood risk in Europe*

IIASA was asked by the EU Parliament to provide expert witness at hearings addressing reforms of the EU Solidarity Fund.

- How robust is the Fund in light of climate change?
- Does it promote solidarity?
- Does it provide incentives for risk reduction?

# Regional policy story: the science

## *Correlated flood risk in Europe*



Jongman, et al, 2014

Borgomeo, Pflug, Hochrainer-Stigler, Hall  
(submitted) Water Resources Research

# National policy story

## *A flexible and agile Finland*

Based on an IIASA-led project, the Finnish Government chose risk & resilience as one of the cross cutting themes of the their Futures Review 2030, which has become the basis of strategic planning in government agencies.

### Partners:

- 6 ministries
- 4 industrial federations
- 3 companies

#### WHAT IS THE AIM OF THE CHANGE?

### A flexible and agile Finland

To succeed in the future, Finland must have an agile national economy, since transformations in the world are difficult to foresee. Risk management alone will be of no avail – what is required is a means of ensuring Finland's ability to succeed, regardless of surprises. The key task of the public sector is to build an operating environment that helps in capitalising on rapid change and uncertainty.

A diverse range of uncertainty factors exists: the political situation in China and Russia, the spread of political populism, stagnating economic growth in Western countries and weaknesses in the international financial system. All of these are resulting in major instability. Other factors hampering futures analysis include climate change, increasing inequality between people, global migration and the increasing number of 'global nomads', i.e. highly mobile people who travel from one country to another on a regular basis. Huge advances in technology, such as new forms of energy production including cold fusion, and singularity in information technology, i.e. the capacity of computers to make new computers, could change the entire economic system.

#### Diversity and renewal as a buffer in the face of change

Finland needs to be capable of building a diverse mosaic in terms of its economic structure, since investing in special areas of expertise would represent too bold a gamble. Enterprises with a lower degree of differentiation would form the basis of a solid economy. They would also serve neighbouring markets and serve as buffers against sudden movements in the global economy and changes in demand.

Economic growth requires a base of unique and diverse exports. As a small country, Finland must be at the right place at the right time, in order to capitalise on rapid economic growth phenomena. To benefit from global resources and competencies, we must assume an active role in value networks. We will achieve a key role by offering something unique that is hard to copy.

Together, the public and private sectors – ppp-partnership – can produce services for the world markets that are difficult to replicate. An innovation strategy covering the entire country and the government foresight work are examples of possible competence-based export products. Finland could also serve as a forerunner in producing reliable crowd funding services, accumulating capital on the Internet for Finnish SMEs and offering the same services to Russian innovation companies.

In the future, flexible regulation may become a key competitive asset, since all countries will be expected to show increasing resilience, i.e. persistent adaptation. Finland has a good starting point, because we are a small, agile country able to react quickly. If we develop our regulations to support flexible and rapid decision-making, we may even become the world's fastest-adapting operating environment.

#### Flexibility for employees and support for entrepreneurs

People experience wellbeing when able to capitalise on personal strengths. An individual must be able to move from one competence and job to another, according to changing conditions and personal wishes. More possibilities and incentives must be provided for self-employment. Although the Finnish educational system has succeeded well in global comparisons, it requires partial reform. We must be able to train multiskilled, active individuals able to adapt to different roles, instead of experts specialising in narrow niche areas. Continuous renewal calls for closer cooperation between working life and education and training. Support for entrepreneurship also needs structural changes. Fast changes demand fast decision making and risk taking from entrepreneurs. Through risk taking, we can gain considerable benefits for the national economy. Safety networks should be constructed for risk venturing, networks that will not punish an active entrepreneur with the loss of social benefits. Part-time entrepreneurship would be a viable solution that would facilitate entrepreneurship engaged in alongside paid work. To avoid burdening individuals with the task of creating all of the flexibility required, structures must be renewed. This, in turn, will require the renewal of corporate and labour legislation.

## National policy story

A flexible and agile Finland

# The approach

## Broad participation

- Identify shocks
- Identify their direct and indirect impacts
- Collect ideas on actions
- Assessment of actions by experts
- Robust portfolio modeling

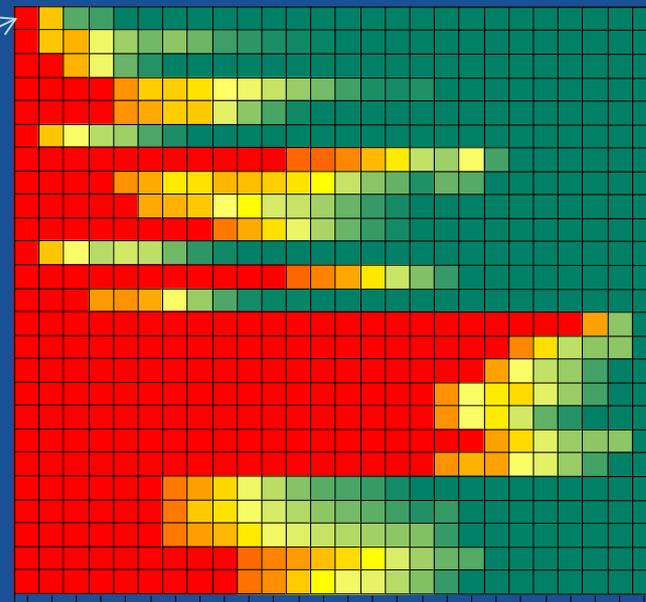
Foresight assessments on-going in Scotland and South Korea.

Nokia relocates out of Finland

Invest to maintain trust

Actions

Number of actions for a robust portfolio



# Local policy story

## *Reconciling conflicts for managing landslide risk in Nocera Inferiore*

IIASA designed and ran a 3-year participatory process, resulting in an agreed compromise on reducing the risk of landslide



# Local policy story: Reducing landslide risk in Nocera Inferiore

## The approach

### Analytical-deliberative process

- Beyond interests (winners and losers)
- To values/cultural identities  
(contending voices/lenses)
- Co-production of policy options
- Compromise not consensus



# Emerging policy story

## *Systemic risk*

The likelihood and consequence of *cascading failures* in networks characterizing a broad range of natural and human-made systems.

The stage was set by examining the challenges of managing “femtorisks” in complex adaptive systems, where a seemingly small-scale event can cascade to trigger consequences throughout the system.



Financial systems



Food webs/ecosystems



Frank, Collins,  
Levin, et al 2014

# End

Risk analysis / modeling

Risk governance

Financial risk management

Risk reduction

Stress testing

Systemic risk



Cultural identities

Risk perception

Public acceptance

Stakeholder processes

Foresight studies

Resilience

## National policy story

A flexible and agile Finland

# The approach

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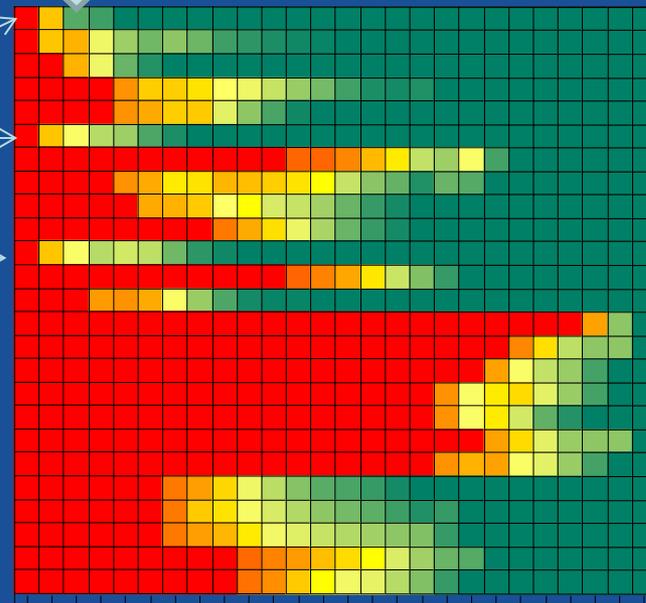
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Invest to  
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Actions

Number of actions in a robust portfolio



# Refocusing disaster aid

Should donors consider switching priority from post-disaster aid to supporting pre-disaster insurance and other financial instruments?

Are financial instruments needed by the poor?

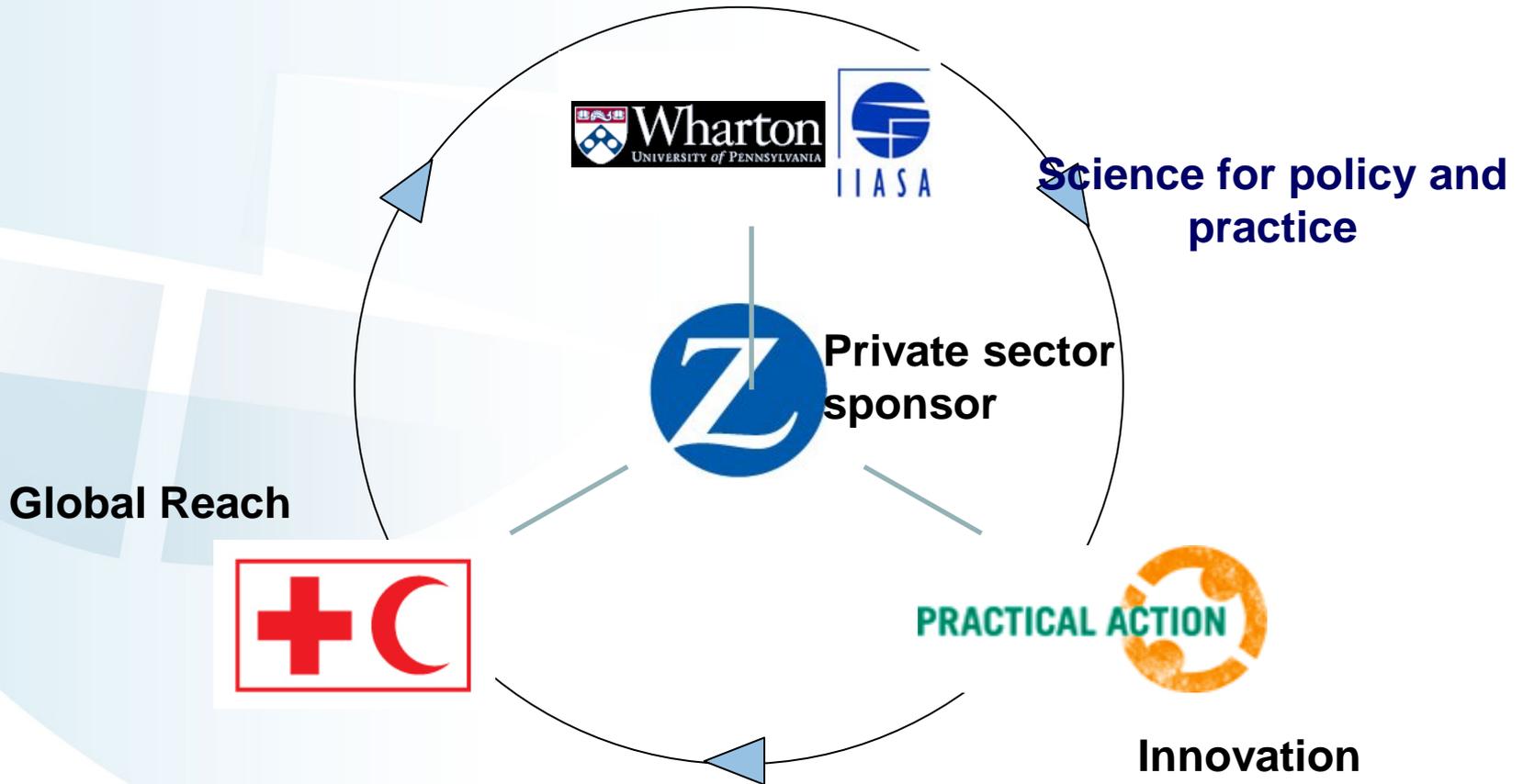
Can these instruments provide affordable safety nets?



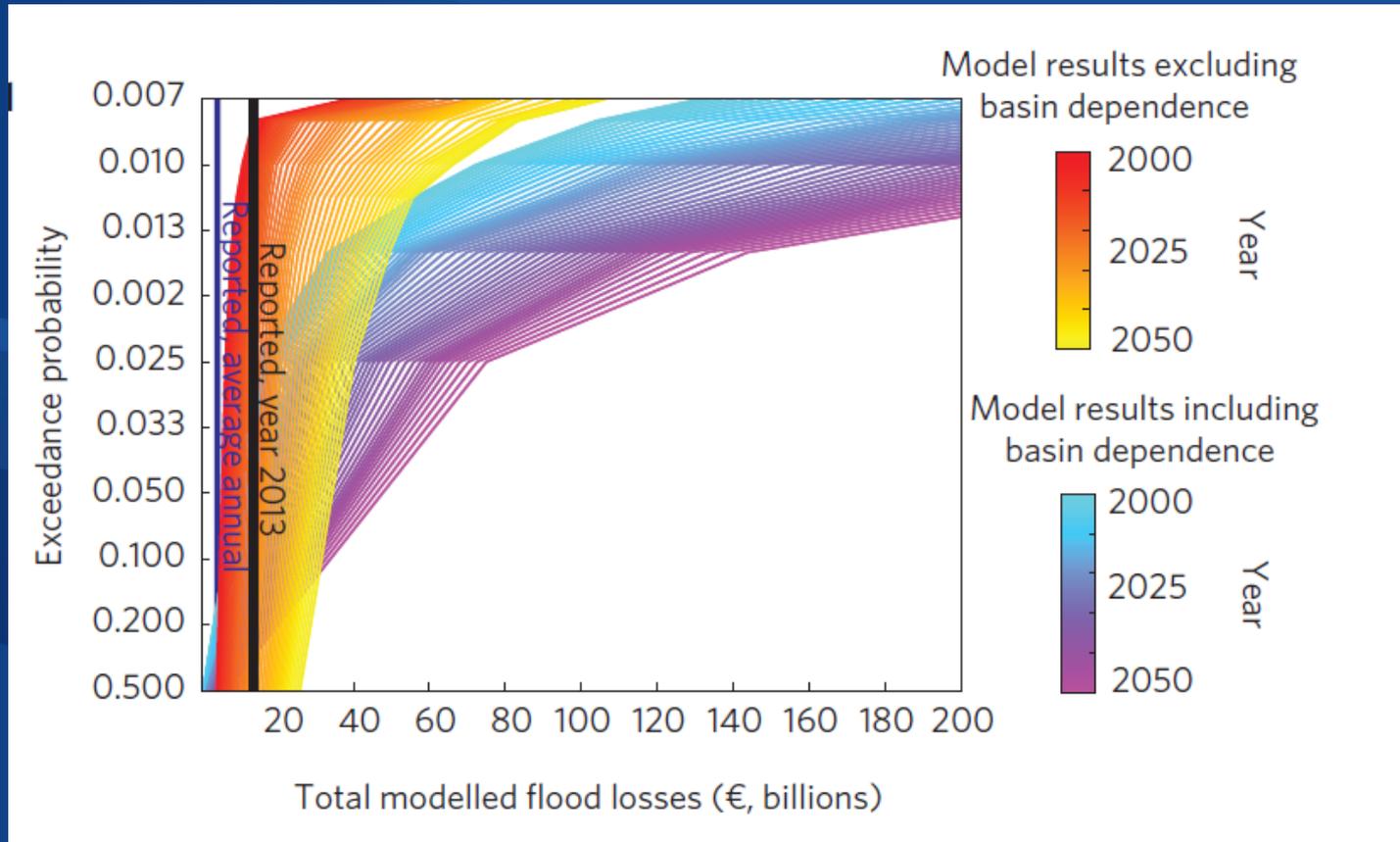
Linnerooth-Bayer et al 2005

# Flood resilience project: a new cross-sector collaboration to catalyze change

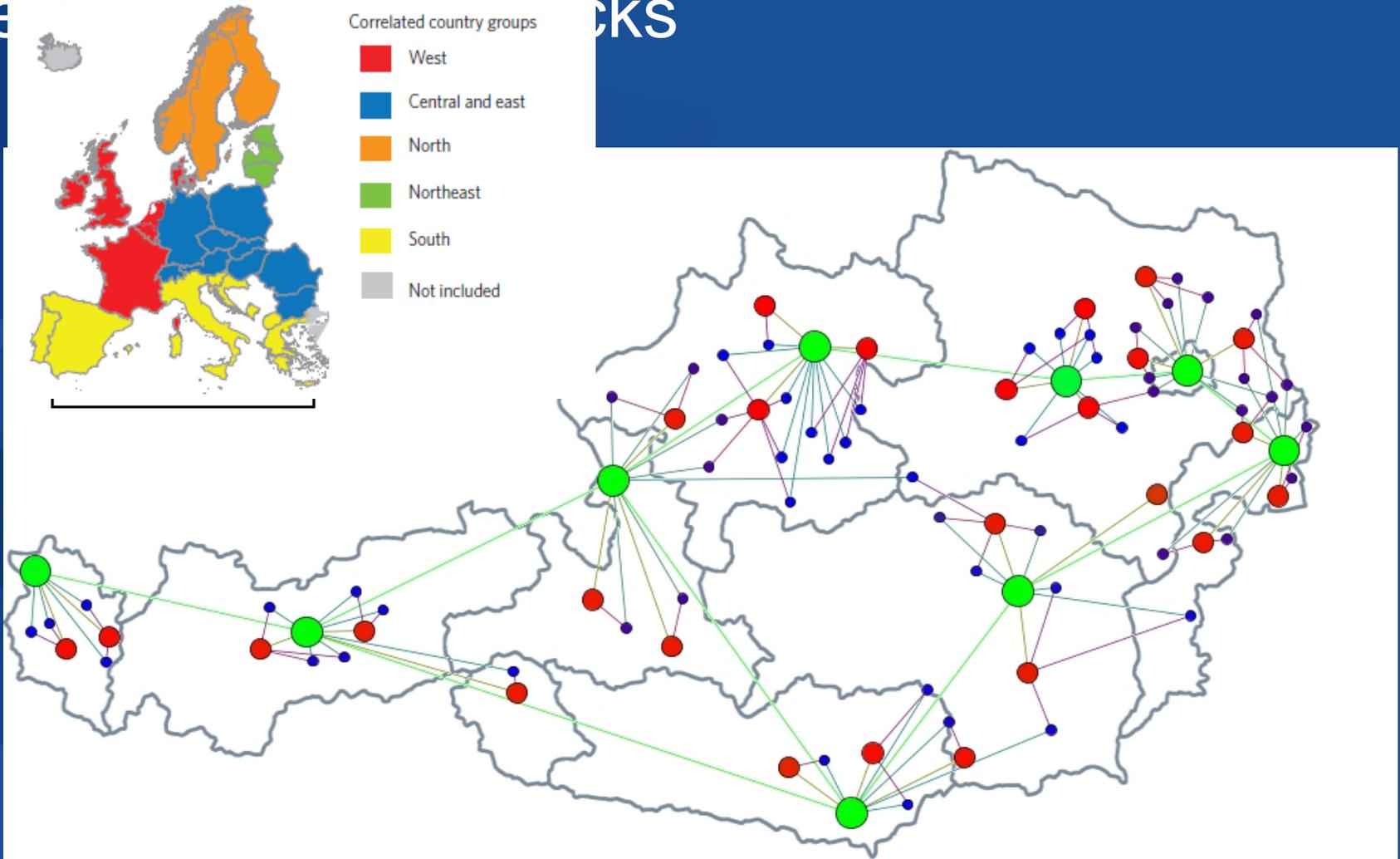
Chosen by UN's Momentum for Change initiative as an exemplary Lighthouse Activity in 2014 at COP 20 in Lima



# Basin correlation of floods highly important for risk management of extremes.

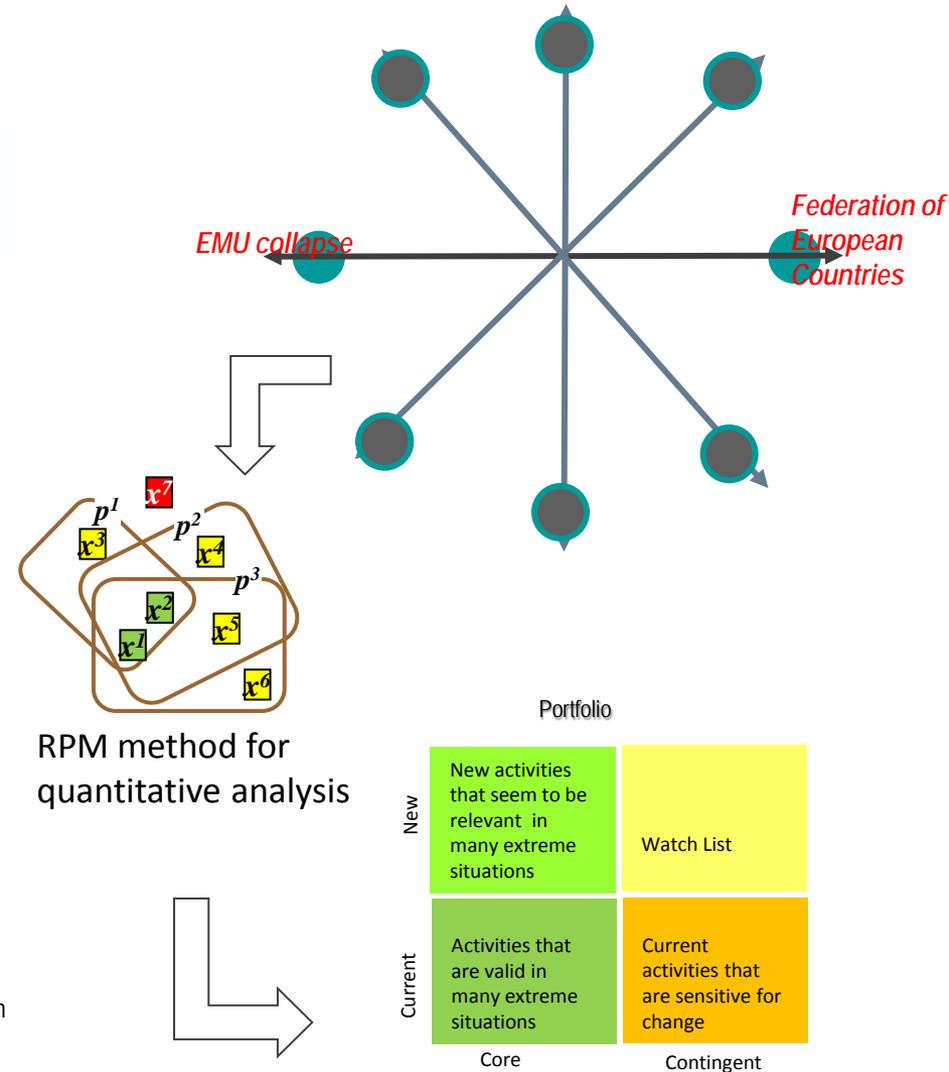


# Combining financial system risk with event networks



# Seven Shocks Portfolio Method

1. Descriptions of shock environments
2. Success strategies for each shock environment
3. Assessment of activities' benefits
4. Potential portfolio that will produce success no matter what happens



Ilmola and Rovenskaya (2014) Three experiments: exploration of unknown unknowns in foresight, *Technology Forecasting and Social Change (in press)*

# Femtorisks in Complex Adaptive Systems

A femtorisk is a seemingly small-scale event that can cascade to trigger consequences at higher levels of organization

## Managing femtorisks (resilience):

Flexible and adaptive response inspired by, for example, the human immune system:

- diversity of response options,
- functional redundancies
- modularity.

Frank, Collins, Levin, et al 2014

