

# Flood resilience: Improving effectiveness by building bridges across the stakeholder chains for better preparedness

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# Key influences

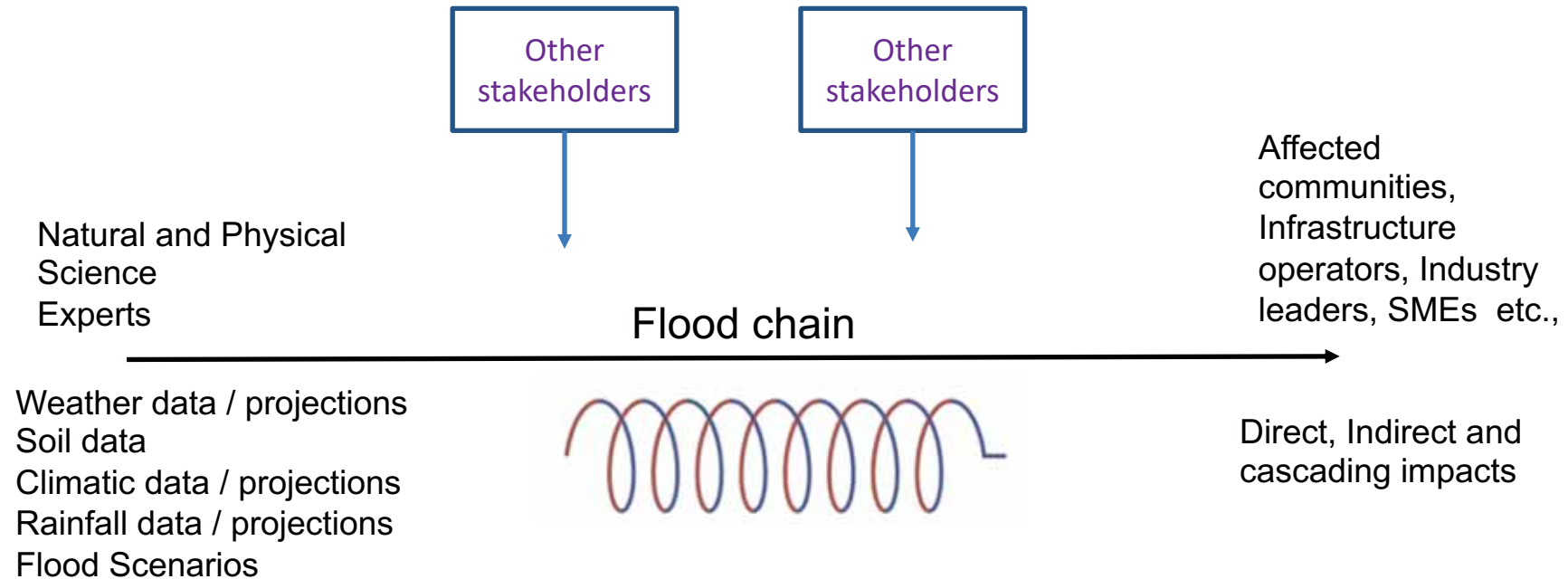
- Partner in EU-CIRCLE - an EU project on critical infrastructure resilience and indicators – ongoing case study in Khulna city Bangladesh (EU- CIRCLE project is a European Horizon 2020 funded project with 20 project partners in the EU region)
- Have worked on investigating community resilience and stakeholder engagement within international contexts with partners in Malaysia, Thailand, Bangladesh, Singapore and Sri Lanka
- Chapters in UNISDR Global Assessment Report 2013, 2015 in private sector engagement in disaster risk management
- Co-author of the UK Climate Change Risk Assessment (UKCCRA) in 2017

# Flooding

- A global problem
- Resulting in loss of lives, catastrophic failures of systems, economic losses, social problems
- Disease and health issues
- Damage as well as disruption
- Primary and secondary impacts, cascading impacts
- Effects of climate change are set to make things even worse



# Flood chain & stakeholders



# What is resilience?



## What is resilience?

- Ability to “bounce back”
- Adapting to hardships and setbacks in life



## What is Resilience



- It is generally defined as the ability to “bounce back” to healthy functioning when faced with significant stressors and events.
- Resilience does not eliminate stress or erase life's difficulties. Instead, it gives people the strength to tackle problems head on, overcome adversity and move on with their lives.
- Resilience develops as people grow up and gain better thinking and self-management skills and more knowledge.

TECHNOLOGY

## Houston's Flood Is a Design Problem

It's not because the water comes in. It's because it is forced to leave again.

IAN BOGOST AUG 28, 2017



# The Telegraph

## Floods are judgment on society, say bishops

By Jonathan Wynne-Jones

12:01AM BST 01 Jul 2007

BBC



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## NEWS

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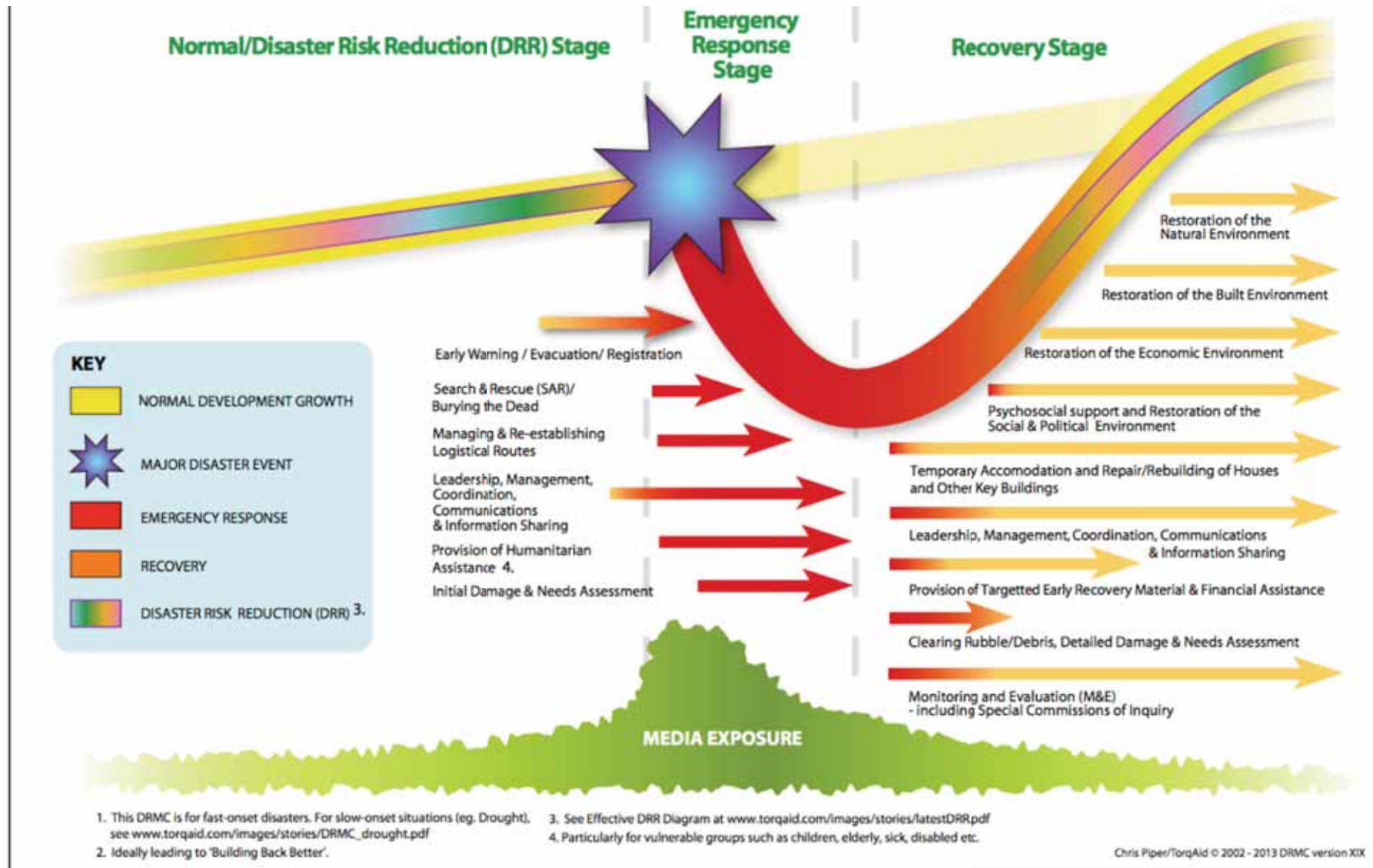
Companies

Economy

## Basic flood protection 'missing in high risk areas'

By Roger Handberg

# Disaster Risk reduction cycle and Media exposure



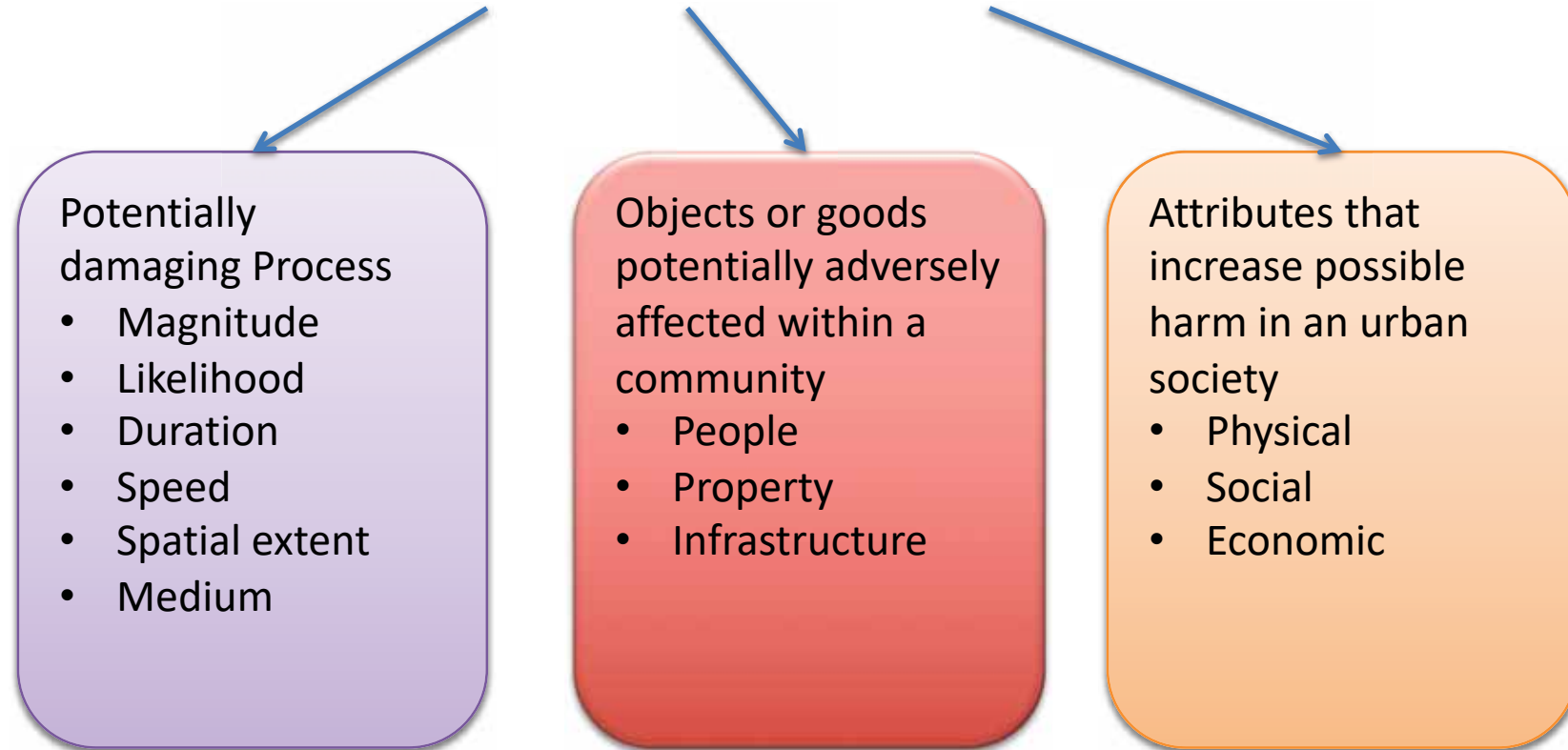
# Disaster Resilience of a Place (DROP) (Cutters, 2008)

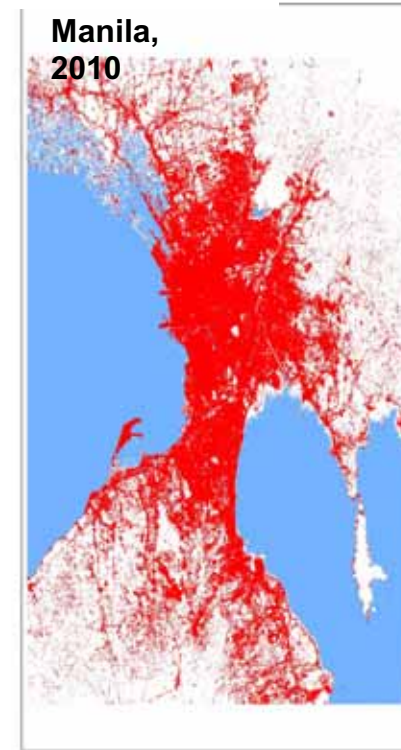
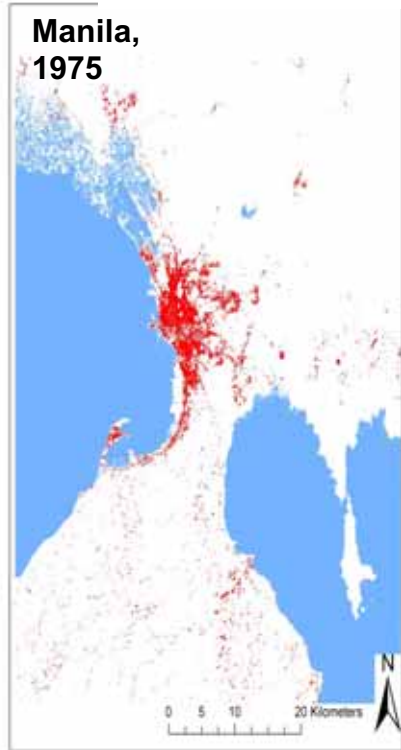
- Vulnerability and resilience is context or place dependent
- Social acceptance or tolerance of risk is different from place to place
- Several other factors that dictate space dependency



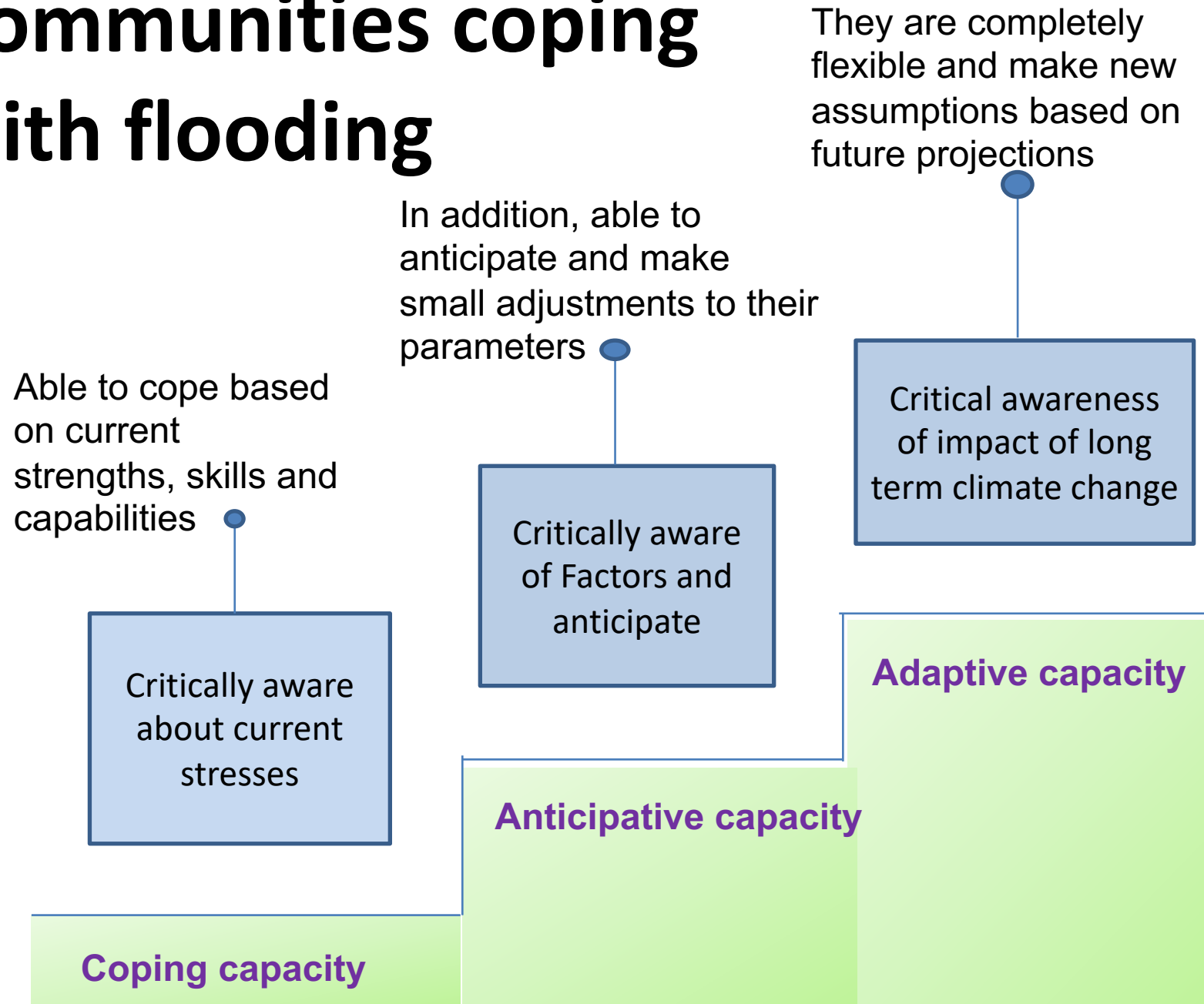
# Disaster Risk being expressed as a function of the hazard, exposure and vulnerability within a community

Disaster Risk = f {Hazard, Exposure and Vulnerability}





# Communities coping with flooding



# Building Resilience: what is the current capacity and where do you want to go from here?

The ability of system to face and manage adverse conditions using available skills and resources



Coping

Anticipative

Adaptive

# Building Resilience: what is the current capacity and where do you want to go from here?

The ability of the system to anticipate and reduce the impact



Coping

Anticipative

Adaptive

# Building Resilience : what is the current capacity and where do you want to go from here?

The ability of a CI system to adjust and to take advantage of opportunities against potential impacts



Coping

Anticipative

Adaptive

**Do communities receive the information that they need to prepare for flooding - or is this more complex than one might think?**

So what is the missing link? What do communities need to fine tune their capacity developments?

# CASE: Khulna City, Bangladesh

Historical and projected risks to Khulna City and environs.

Enables strength testing of different systems.

1. Direct Cyclone strike
2. Indirect Cyclone strike
3. Cyclone accompanied by significant Storm Surge

Working with national and local stakeholders

- Ministry of Disaster Management and Relief
- Bangladesh Water Development Board
- Roads and Highways
- Local Government Authorities
- Khulna development authority
- Khulna University of Engineering and Technology





CIRP - Critical Infrastructure Resilience Platform

System Reports Dataset Scenario Users Analysis Measurements Navigation Tools Layers Effects Perspectives Preferences Windows Curve Editor Help

Feature Layer Imagery Layer Deviation Layer 3D Terrain Quality

Scenario Manager Static Information Layers 3D Map

Search Name: [ ]

- Borders and Places
  - OSM Places
- Points of Interest
  - OSM Buildings
  - OSM Roads
- DEM
- Powerlines
- Wind
  - Nergo Results
    - Nergo Results
      - KhulnaBuildingWindDamaged Nergo
      - Nergo Results
        - KhulnaPowerNetworkPolesDamaged Nergo Typhoon
        - KhulnaPowerNetworkPolesFalen Nergo Typhoon
        - transportNetworkLinkBlocked
        - KhulnaPowerNetworkPolesDamaged Nergo Typhoon
    - Wind-Buildings Damage Classes

- BaseMap

Catalog CS4 (CS4)

- Power Network Poles
- Power Network Poles Wind Damage Curves
- Power Network Poles Wind Damage Curves Mapping

Execute Cancel

**Power Network Poles Wind Impact Analysis** - All required fields must be completed


Required

Result Name: [ ]

Result Name (Polyline): [ ]

Power Network Poles: Khulna Power Network Poles

Power Network Poles Wind Damage Curves: Khulna Power Network Poles Wind Damage Curves



satways

Kostas Antonis EU-CIRCLE

satways Connected to Excellence

3D Map

Person icon + -

# CIRP - Critical Infrastructure Resilience Platform

## Case Study 4: Khulna

satways Ltd

Buffering 22.6544 N 89.5329 E Alt: 1368.30 Mm AGL Dist: 6.99

# Bangladesh

- City of Khulna faces frequent flood events triggered through cyclonic pressures.
- The impacts are triggered as
  - storm surges,
  - heavy winds
  - Tidal surges
- Our visualization helps infrastructure providers to understand the impacts and consequences better (to avoid assembling and re-assembling).
- A lot of buildings have been adapted, industries have been adapted, and sectors such as agriculture have been adapted



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7th International Conference on Building Resilience; Using scientific knowledge to inform policy and practice in disaster risk reduction, ICBR2017, 27 – 29 November 2017, Bangkok, Thailand

## Assembling and (Re)Assembling Critical Infrastructure Resilience in Khulna City, Bangladesh

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### Abstract

Extreme Weather Events continue to cause shocking losses of life and long-term damage at scales, depths and complexities that elude robust and accountable calculation, expression and repair. Cyclones and storm surges can wipe out entire towns, and overwhelm vulnerable built and lived environments. It was storm surges that was integral to the destructive power of Hurricane Katrina in the USA (2005), Typhoon Haiyan in the Philippines (2013), as well as Cyclone Nargis (2008) and the 1970 Bhola Cyclone in the Bay of Bengal. This paper report on work which concerns itself with the question of, given what we know already about such extreme weather events, and their associated critical infrastructure impacts and recovery trajectories, what scenarios, insights and tools might we develop to enable critical infrastructures which are resilient?

With several of the world's most climate vulnerable cities situated in well-peopled and rapidly growing urban areas near coasts, our case study of Khulna City speaks globally into a resilience discourse, through critical infrastructure, disaster risk reduction, through spatial data science and high visualisation. With a current population of 1.4 million estimated to rise to 2.9 million by 2030, dense historical Khulna City may well continue to perform a critical role in regional economic development and as well as a destination for environmental refugees.

Working as part of the EU—CIRCLE consortium<sup>1</sup>, we conduct a case study into cyclones and storm surges affecting the critical infrastructure then discuss salient developments of loss modelling. The research aims to contribute towards a practical framework that stimulates adaptive learning across multiple stakeholders and organisational genres.

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**Keywords:** climate change; critical infrastructure; extreme weather; resilience

# Conclusions

- To enable effective preparedness from the communities they need better understanding of impacts that are likely to happen
- There should be more stakeholder collaboration across the chain, which should inform better coping response from the communities and infrastructure operators.
- Therefore several policy making initiatives can emerge due to the growing need of the science to be more relevant to the communities who are then able to better prepare for flood impacts