CORFU
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METHODOLOGY FOR FLOOD RESILIENCE INDEX

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Outline

- Introduction
- Resilience and vulnerability
- Adding resilience to flood risk management
- Methodology
- Conclusion

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Introduction

- The shift from traditional flood risk management put a vulnerability in the focus
- Shift is done from typical technical solutions that is provided by pure engineering science to a concept of understanding the conditions associated with human actions, economic change and institutional capacity

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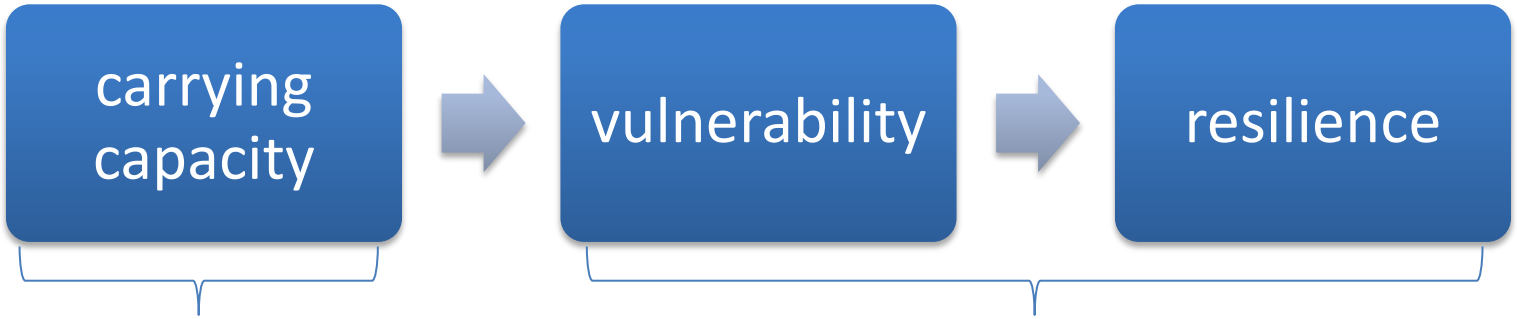
Resilience and vulnerability

- System from an ecological point of view doesn't need to define the conditions which will provide some functionality and structure
- Driving approach to improve sustainability of urban systems to flooding processes (resilience concept)
- Resilience of physical and social components of urban system
- How to describe and assess flood risk in urban systems (city)?



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Resilience and vulnerability

- Resilience of urban systems – to what? Up to what level?
- It can be defined by identifying what system attributes are to be resilient, and to what kind of disturbances.

3 Directions for preventing an urban system to become unstable

Adjusting the thresholds of a system in respect to changes in response to flood waves

Defining the level to which system is capable of self organizing

Define the level to which system is able to build and increase capacity for learning and adaptation

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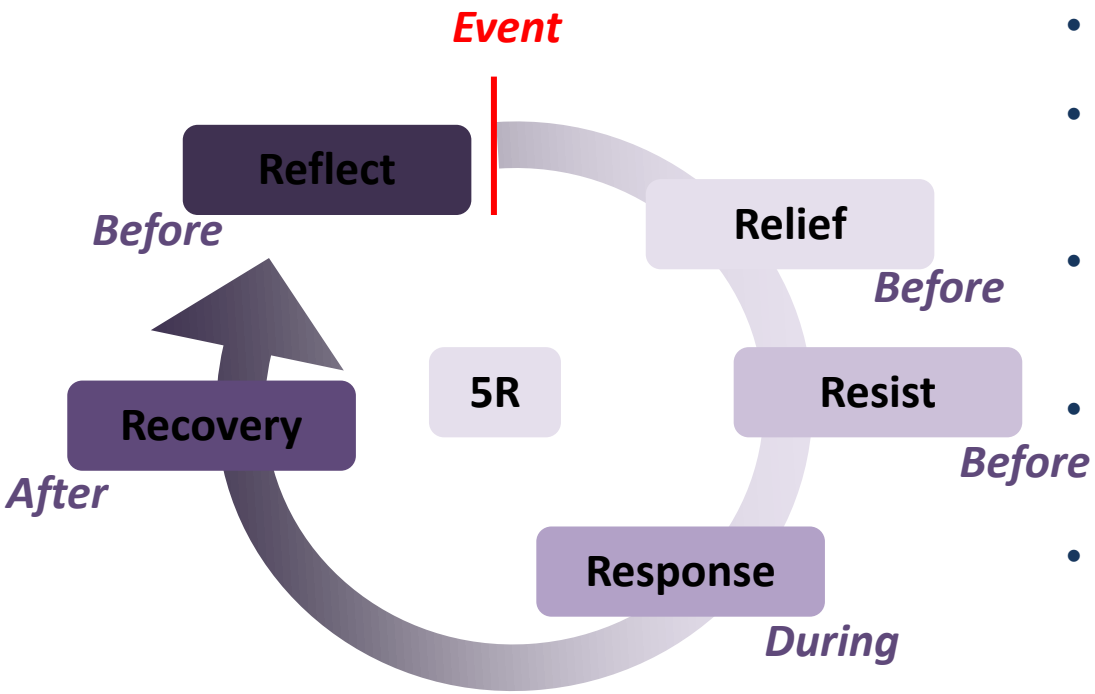
Adding resilience to flood management – 5R



- **Relief** – A buffer element
- **Resist** – Prevention of flood risk if possible, threshold capacity
- **Response** – Measures taken during the flood
- **Recovery** – Providing support to recovery processes
- **Reflect** – Actions focus on increasing awareness and adaptive capacity, learning from past event and/or preparation for an uncertain future

Capacity of urban systems and communities is improved in each part of the flood risk management cycle

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Methodology

- Development of urban flood vulnerability and resilience assessment tools with indicators enables to provide a comprehensive overview of vulnerability and resilience of a city and community
- The relationship between the nature of interaction and the structure of an urban system is fundamental

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Methodology – scales for analysis

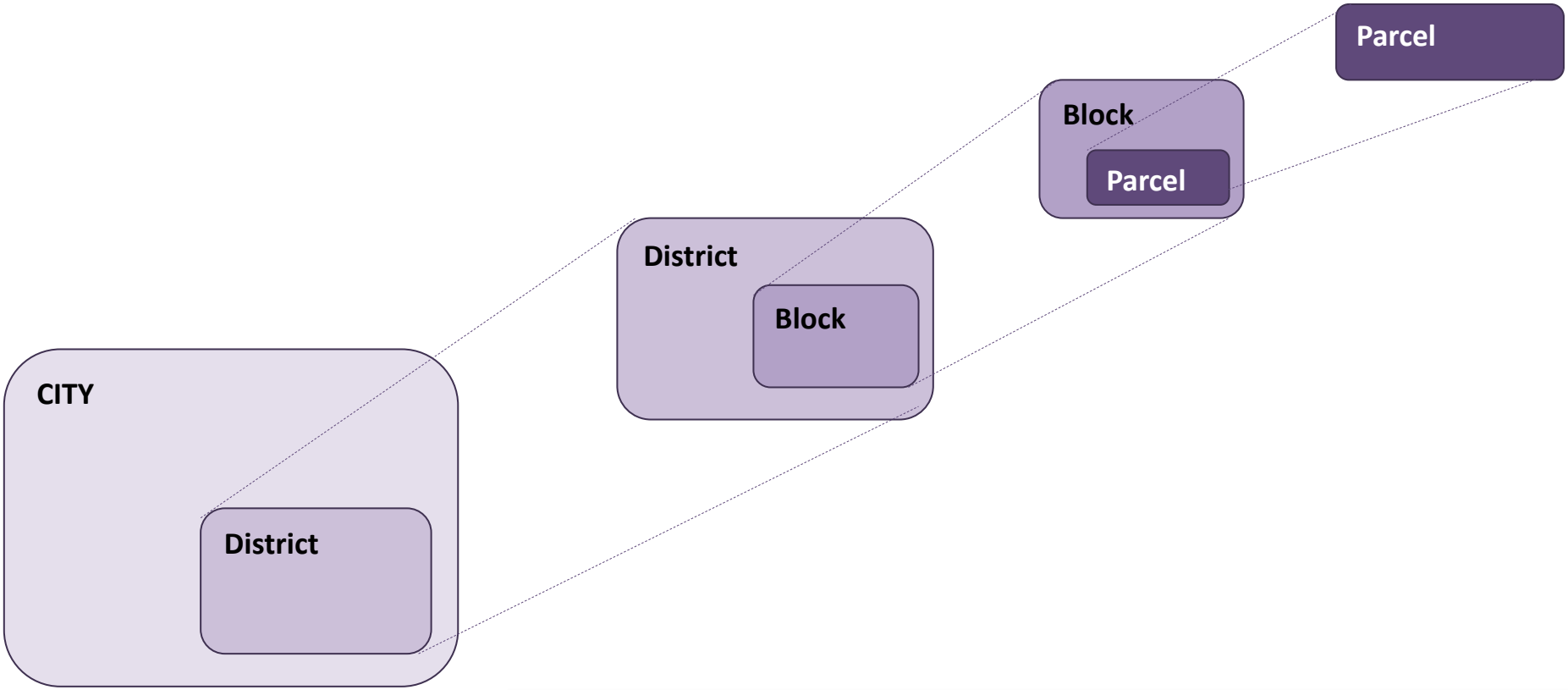
Energy grid / smart grid → Convergence/ Resilience

Water grid / water cell → Convergence/ Resilience

Risk management → Convergence/ Resilience

New urban environments based on urban cells integrating services (specific scale)

Methodology – scales for analysis



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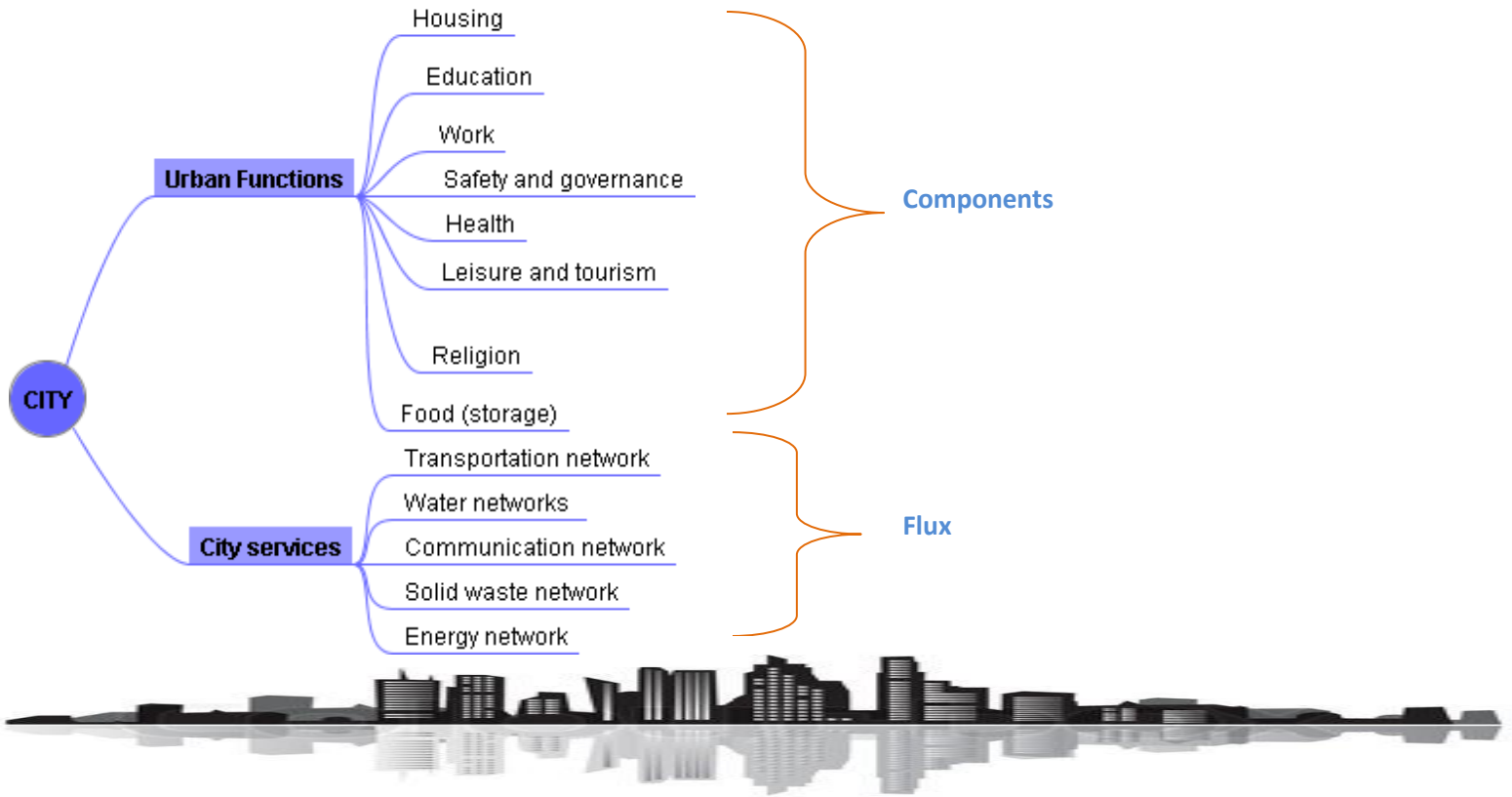
Methodology – mapping urban system



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Methodology – Flood Resilience Index (FRI)

- Index is represented as a **level of flood resilience assessment in analyzed area and for certain flood characteristics**
- Critical assumptions:
  - method is a simplification of reality
  - addressing the flooding processes in urban systems

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Methodology – Flood Resilience Index (FRI)

- The urban system is considered through five dimensions: natural, physical, economical, social and institutional
- The indicators are chosen according to the following criteria:
  - Sensitivity
  - Availability
  - Affordability and
  - Relevance
- The evaluation of the Flood Resilience Index (FRI) on parcel/building and the block scale focuses on urban function
- The evaluation of FRI for the city and district scale is done through five dimensions: natural, physical, social, economic and institutional.

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Methodology – **FRI on parcel/building scale**

- Physical components of urban system have a unique building topology. There are eight different **building typologies** for analysis that will filter requirements for urban functions and for city services
  - Services (related to external dependencies)
  - Safety of urban function (related to the safety for users)

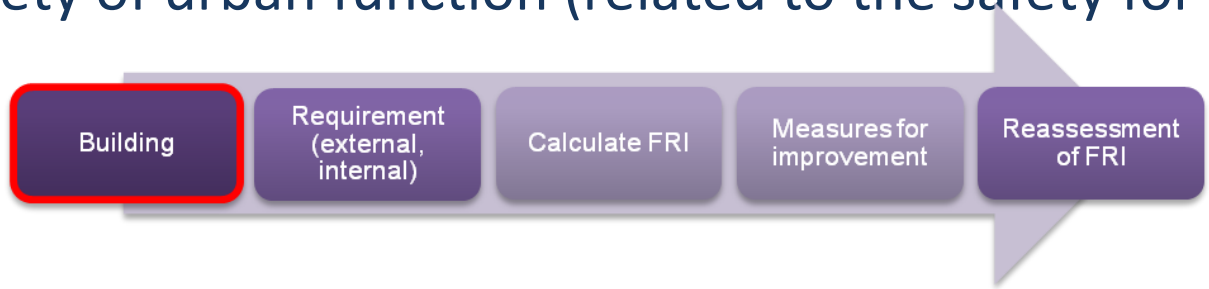

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Table 1: Availability levels of urban functions

Availability level	Description
0	Not available
1	Poor availability – major interruptions
2	Low availability – interruptions provide minimum availability
3	Medium – small interruptions that are tolerable for small flood durations
4	Medium-high – interruptions that are tolerable for long flood durations
5	Requirement fully provided

Table 2: Evaluation of FRI for building scale

Requirements for urban function	Availability level (0 – 5)	FRI (parcel/building scale)
EXTERNAL SERVICES		$FRI(building) = \frac{\text{Availability level}}{8}$
Energy	1,2,3,4,5	
Water	1,2,3,4,5	
Waste	1,2,3,4,5	
Communication	1,2,3,4,5	
Transport	1,2,3,4,5	
INTERNAL SERVICES		
Food availability	1,2,3,4,5	
Occupation of urban function	1,2,3,4,5	
Access to the urban function	1,2,3,4,5	

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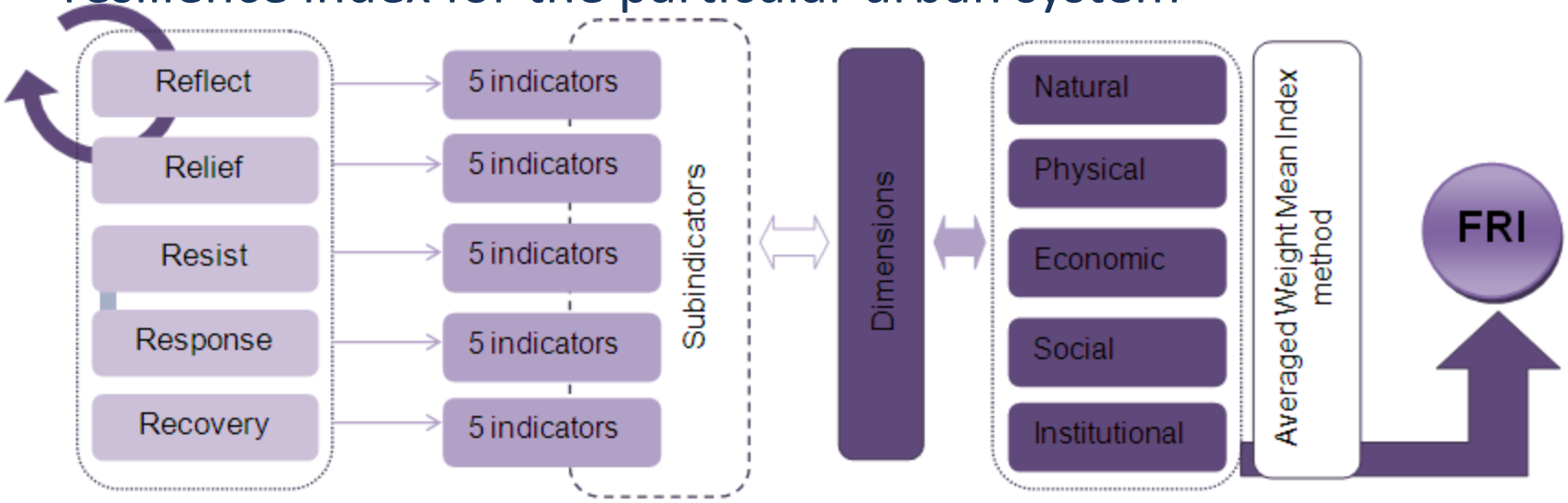
Methodology – **FRI for city/district scale**

- Focusing on 5 dimensions
- Each dimension contributes to the evaluation of the flood resilience index for the particular urban system



Schematic presentation of FRI evaluation of city/district scale

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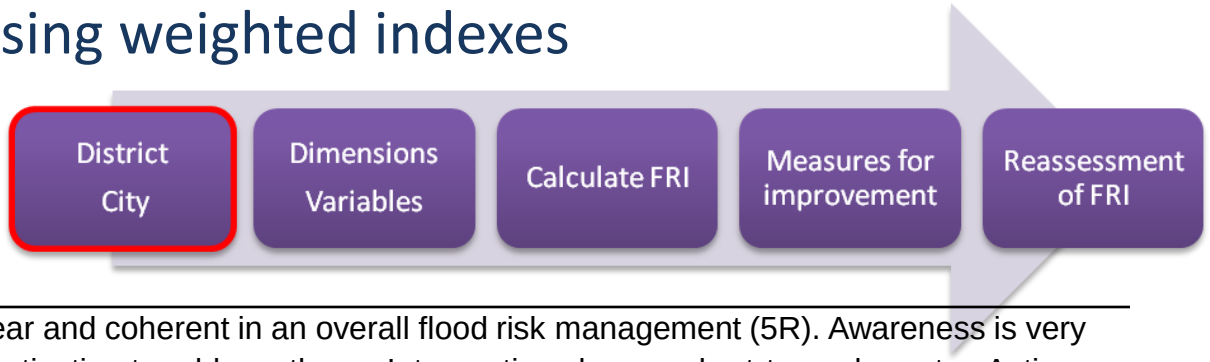
Methodology – **FRI for city/district scale**

- Constructions of a rating scale with weights for all variables need to be done using weighted indexes



Very low 0-2	The activities are not clear and coherent in an overall flood risk management (5R). Awareness is very low on the issues and motivation to address them. Interventions have a short-term character. Actions limited to crisis response.
Low 2-3	Awareness of the issues and motivation to address them exist. Capacity building of human resources remains limited. Capacity to act is improved and substantial. Interventions are more numerous and long-term. Development and implementation of solutions.
Medium 3-4	Integration and implementation of solutions is higher. Interventions are extensive, covering all main aspects of the 'problem', and they are linked within a coherent long-term strategy.
High 4-5	A "culture of safety" exists among all stakeholders, where the resilience concept is embedded in all relevant policies, planning, practice, attitudes and behaviour.

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Limitations of the proposed index

- The outcome indicators were developed from actions in flood risk management cycle.
- The flood resilience index still depends on some assumptions.
- The proposed measurement of indicators relies on weights (assign for each indicator).
- Some limitations related to providing a quality measure of the process are possible since weights are used to intensify the scores in the assessment

Conclusion

- The flood resilience concept brings a new philosophy to urban systems, 'living with floods'
- The Flood Resilience Index (FRI) represents a tool for stakeholders and decision makers
- The imperative is to acknowledge the importance of social, institutional and economical component when managing flood risk

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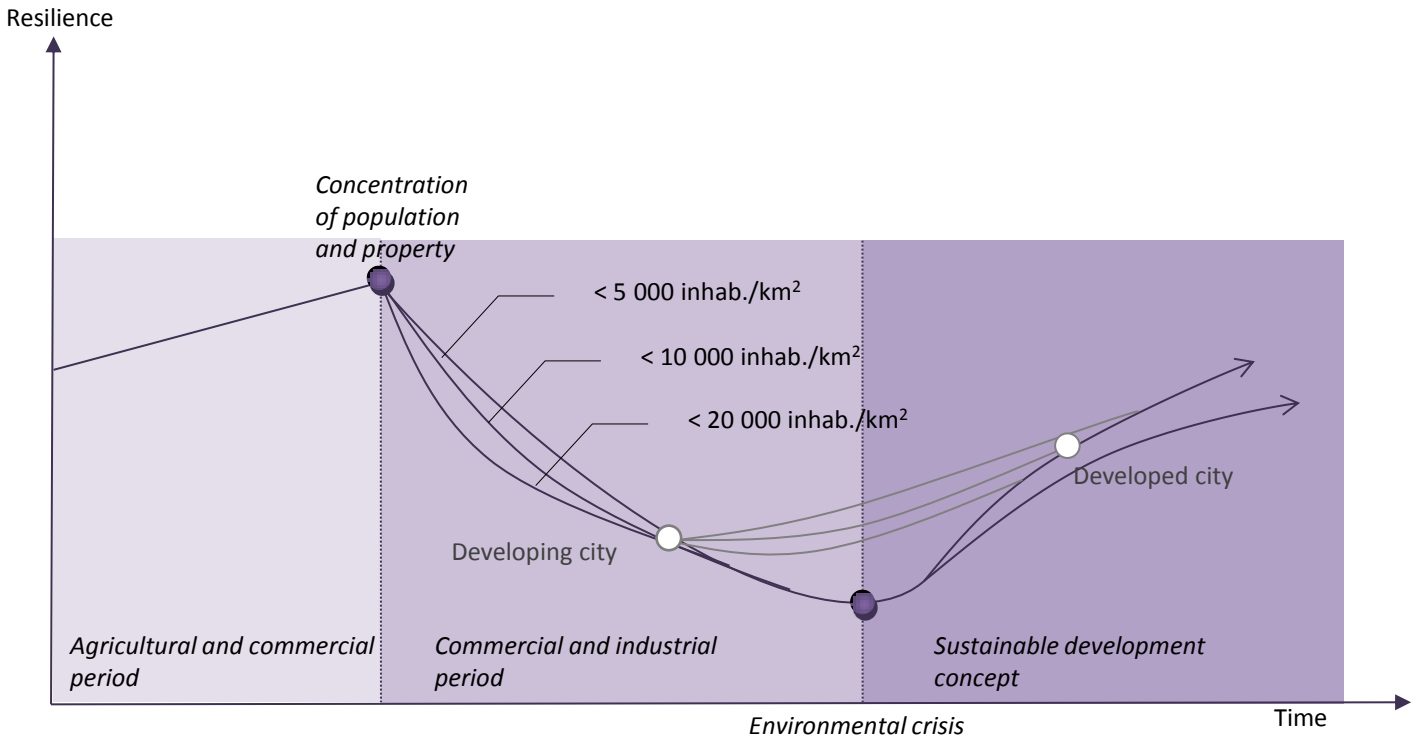
Theoretical presentation of flood resilience dynamics



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Conclusion

- The importance is in the possibility to use experience from flood resilience urban systems and avoid huge flood damages and dysfunction.
- The developing urban systems can find a good practice and good paths towards flood resiliency without reaching a low level of functioning

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Thank you for your attention.

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