Supporting midsize cities towards climate resilience: Insights from the CATCH project

Gül Özerol University of Twente g.ozerol@utwente.nl

10 November 2022 Risk and Resilience Festival





## **Climate** extremes and risks in cities



https://www.nytimes.com/2016/08/02/science/looking-quickly-for-the-fingerprints-of-climate-change.html



## Floods

#### **Climate threat**

- Sea level rise
- River flows
- Heavy rainfall

#### **Exposure and sensitivity**

- Residential areas exposed by low elevation
- Buildings in risk areas





## Droughts

#### **Climate threat**

Increased precipitation deficit

#### **Exposure and sensitivity**

- Drop of groundwater table
- Increase in soil compaction
- Damage to historic buildings





### Heatwaves

#### **Climate threat**

Increased temperatures

#### **Exposure and sensitivity**

- Urban heat island effect
- Unpleasant or unsuitable outdoors





# **Urban climate resilience**

Climate change is **one of many stresses and shocks** that cities experience. Effects combined with other stresses and shocks (e.g., population growth and migration).

Multiple characteristics: **flexibility, diversity, adaptive governance,** and **capacity** for innovation and learning

Efforts to foster resilience should be **integrated with broader development** plans.

Leichenko, R. (2011). Climate change and urban resilience. Current Opinion in Environmental Sustainability.



# **Climate change adaptation & cities**

*"The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities." (IPCC, 2018)* 

Shifting attention from (inter)national policy to the local level (cities!)

# Do cities have the resources to implement climate change adaptation measures towards climate resilience?

IPCC, 2018. Glossary. https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-AnnexII\_FINAL.pdf



# **CATCH Project (2017-2022)**

'water sensitive Cities: the Answer To CHallenges of extreme weather events'





European Regional Development Fund

EUROPEAN UNION



## Theoretical background: Water Sensitive Cities (WSC)

Cities as Water Sensitive Communities	Cities as Water Catchments	Cities as Ecosystem Service Providers
Stakeholder awareness and participation Communication Rules and regulations	Flood hazard and flood risk information Water storage and infiltration Status and maintenance of water infrastructure	Environmental, economic and social benefits of the urban ecological system
Pillar 1	Pillar 2	Pillar 3

Wong, T. H. F., & Brown, R. R. (2009). The water sensitive city: Principles for practice. *Water Science & Technology*.

## Theoretical background: Urban Water Transitions (UWT)

#### **Cumulative Socio-Political Drivers**



#### **Service Delivery Functions**

Brown, R., Rogers, B., Werbeloff, L. (2016). Moving toward Water Sensitive Cities: A guidance manual for strategists and policy makers. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

## Tailoring the WSC and UWT for midsize cities in the NSR

### **Broader context of NSR**

- Political, social, ecological, climatic similarities and differences

### Specific context of midsize cities

- Governance, social and economic capacity
- "Size matters": Mid-size cities connect local and regional levels
- Problems: Water quality, water storage, rainwater drainage, etc.

### $\rightarrow$ A knowledge co-production process by CATCH partners

Özerol, G., Dolman, N., Bormann, H., Bressers, H., Lulofs, K., Böge, M. (2020). Urban water management and climate change adaptation: A self-assessment study by seven midsize cities in the North Sea Region. *Sustainable Cities and Society*.



## CATCH partner cities and pilot measures

City	Country	City area [km <sup>2</sup> ]	Population	Pilot measure
Herentals	Belgium	39	27,000	Designing a green-blue area in a city development area
Vejle	Denmark	144	55,000	Redesign of a playing field for water storage during heavy rainfall
Oldenburg	Germany	103	164,000	Traffic information for road users during heavy rainfall
Enschede	The Netherlands	143	158,000	'Pinkeltjes Square' - stepping stone in the restoration of a city brook
Zwolle	The Netherlands	119	124,000	Developing a community building strategy and serious game
Arvika	Sweden	11	14,000	Constructed wetlands to reduce the effect of climate change on water quality
Norwich	UK	49	140,000	Community-led technological solutions for flood protection

### WSC index tailored for midsize cities in the NSR

Organizational capacity for climate adaptation at the city levelAvailability and use of flood hazard and flood risk maps for areas at riskAttention to the needs and protection of vulnerable groups against the negative impacts of climate changeWater as a key element in city planning and design/redesignAreas to temporally store water in the city without expected damageAttention to the needs and protection of vulnerable groups against the negative impacts of climate changeCity-level integrative arrangements across sectorsMeasures to increase infiltration Status of infrastructure for water supplyHealthy and biodiverse habitatStakeholder participation in water and climate adaptation Level of flood risk awareness of the populationMaintenance of infrastructure for water supplyProtection of groundwater quality and groundwater levelsStatus of infrastructure for water supplyStatus of infrastructure for water supplyActivation of connected urban green and blue spaceMaintenance of infrastructure for wastewaterWaitewaterVegetation coverage at the city level	Cities as Water Sensitive Communities	Cities as Water Catchments	Cities as Providers of Ecosystem Services
managementStatus of infrastructure for floodRegulations to reduce potential flood damage in the cityprotectionMaintenance of infrastructure for flood protectionMaintenance of infrastructure for flood protection	Organizational capacity for climate adaptation at the city level Water as a key element in city planning and design/redesign City-level integrative arrangements across sectors Stakeholder participation in water and climate adaptation Leadership, long-term vision and commitment by city administration Level of flood risk awareness of the population Organisation of emergency management Regulations to reduce potential flood damage in the city	<ul> <li>Availability and use of flood hazard and flood risk maps for areas at risk</li> <li>Areas to temporally store water in the city without expected damage</li> <li>Measures to increase infiltration</li> <li>Status of infrastructure for water supply</li> <li>Maintenance of infrastructure for water supply</li> <li>Status of infrastructure for wastewater</li> <li>Maintenance of infrastructure for wastewater</li> <li>Status of infrastructure for flood protection</li> <li>Maintenance of infrastructure for flood protection</li> </ul>	<ul> <li>Attention to the needs and protection of vulnerable groups against the negative impacts of climate change</li> <li>Healthy and biodiverse habitat</li> <li>Protection of surface water quality and flow regime</li> <li>Protection of groundwater quality and groundwater levels</li> <li>Activation of connected urban green and blue space</li> <li>Vegetation coverage at the city level</li> </ul>

### Self-assessment of partner cities

Code	C11	C12	C13	C14	C15	C16	C17	C18	C21	C22	C23	C24	C241	C25	C251	C26	C261	C31	C32	C33	C34	C35	C36
City A	3	3	3	4	3	5	4	4	NA	3	3	4	4	4	4	4	NA	4	2	1	4	4	2
City B	4	4	4.5	5	3.5	3.5	2.5	4	5	3	4	4	4	4	4	4	3	2	NA	NA	2	2	3
City C	3	3.5	3	3	3.5	2	3.5	4	4	3	2.5	4	3.5	3.5	3	4	4	1	3	1	3	3.5	2
City D	3	2	3	3	2	3	3	3	4	3	3	4	3	3	3	3	3	3	3	3	3	3	3
City E	3	2	3	2	2	3	4	3	2	1	3	4	4	4	4	1	1	2	1	3	3	4	2.5
City F	4.5	4	4	4.5	4	4	5	3	4	3	3.5	5	5	4	4	3	3.5	4	3.5	4.5	5	3	2
City G	3	4	3	3	4	4	5	3	5	4	5	5	5	5	5	3	5	2	3	3	4	4	5
Average/ indicator	3.4	3.2	3.4	3.5	3.1	3.5	3.9	3.4	4	2.9	3.4	4.3	4.1	3.9	3.9	3.1	3.2	2.6	2.6	2.6	3.4	3.4	2.8
Average/ pillar	ge/ 3.4					3.6						2.9											



### From self-assessment scores to UWT states

C11			
C12			
C13			
C14			
C15			
C16			
C17			
C18			
C21			
C22			
C23			
C24			
C241			
C25			
C251			
C26			
C261			
C31			
C32			
C33			
C34			
C35			
C36			



**Service Delivery Functions** 

## Key insights from the CATCH self-assessment

A strong status in all pillars, but...

### "Cities as ecosystem services providers"

 A common need to identify and value the social, environmental and economic benefits of climate change adaptation measures

### "Cities as communities and networks"

- A common need to mainstream climate change adaptation

### "Cities as water catchments"

- Highest average score among the three pillars
- Largest range of the scores  $\rightarrow$  Differences between the cities in terms of the management of data and infrastructure.

