

Climate change impacts and adaptation policy in the urban context

From IPCC AR6 to AR7

Winston Chow

Co-Chair IPCC WGII AR7

Associate Professor of Urban Climate & Lee Kong Chian Research Fellow

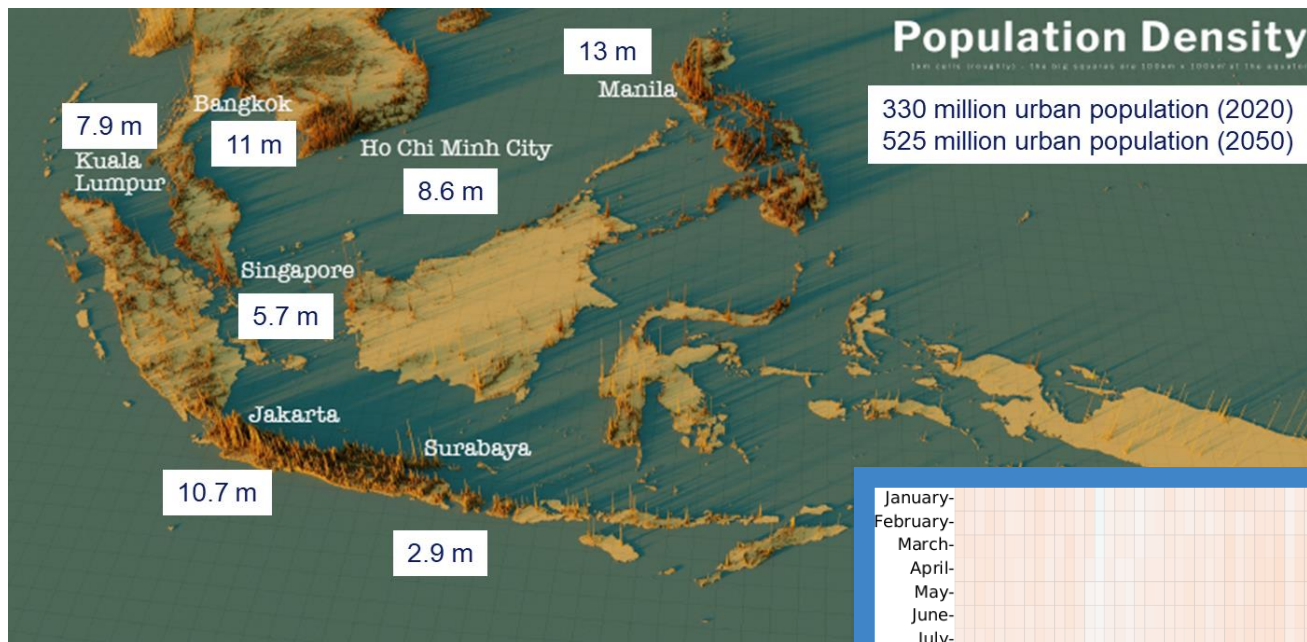
Singapore Management University

October 18 2023

Two takeaways

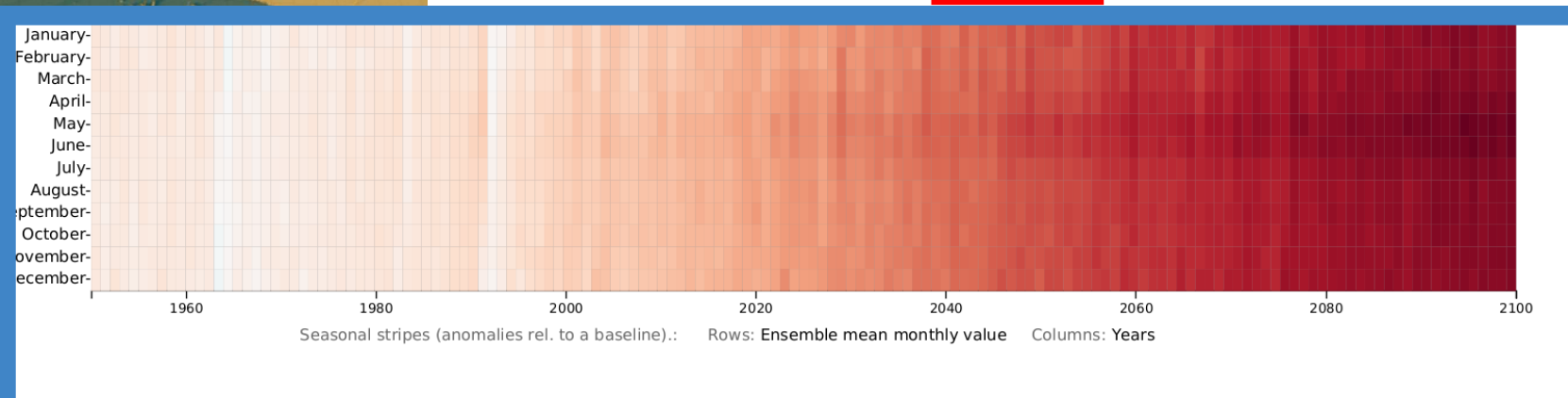
- Urban areas have been – and will continue to be – the foci of many compound and cascading climate impacts and risks
 - Inadvertent risks arising from interactions between two complex systems
- Successful urban adaptation requires climate resilient development to occur
 - Integrating responses and financing are essential steps for success

Urbanisation + climate change = problem



CMIP6 - Mean temperature (T) Change deg C - Medium Term (2041-2060) SSP2-4.5 (rel. to 1850-1900) - Annual (34 models)
Regions: South East Asia

Period	Scenario	Median (deg C)	P25 P75	P10 P90	P5 P95
Near Term (2021-2040)	SSP2-4.5	1.3	1.1 1.4	1.0 1.6	1.0 1.7
Medium Term (2041-2060)	SSP2-4.5	1.7	1.5 1.9	1.4 2.2	1.3 2.3
Long Term (2081-2100)	SSP2-4.5	2.4	2.0 2.8	1.8 3.1	1.8 3.2



Mean temperature (T) - Change (deg C)
SSP2-4.5 (rel. to 1850-1900)
CMIP6 - Annual (34 models)-South East Asia


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Doubling of urban population from 2020 – 2050 in major urban areas in SE Asia

On course for **1.7 °C by 2050** under current emissions trajectory accounting for current Paris Agreement targets

 The difference in **observed** warming trends between cities and their surroundings **can partly be attributed** to urbanization (*very high confidence*).

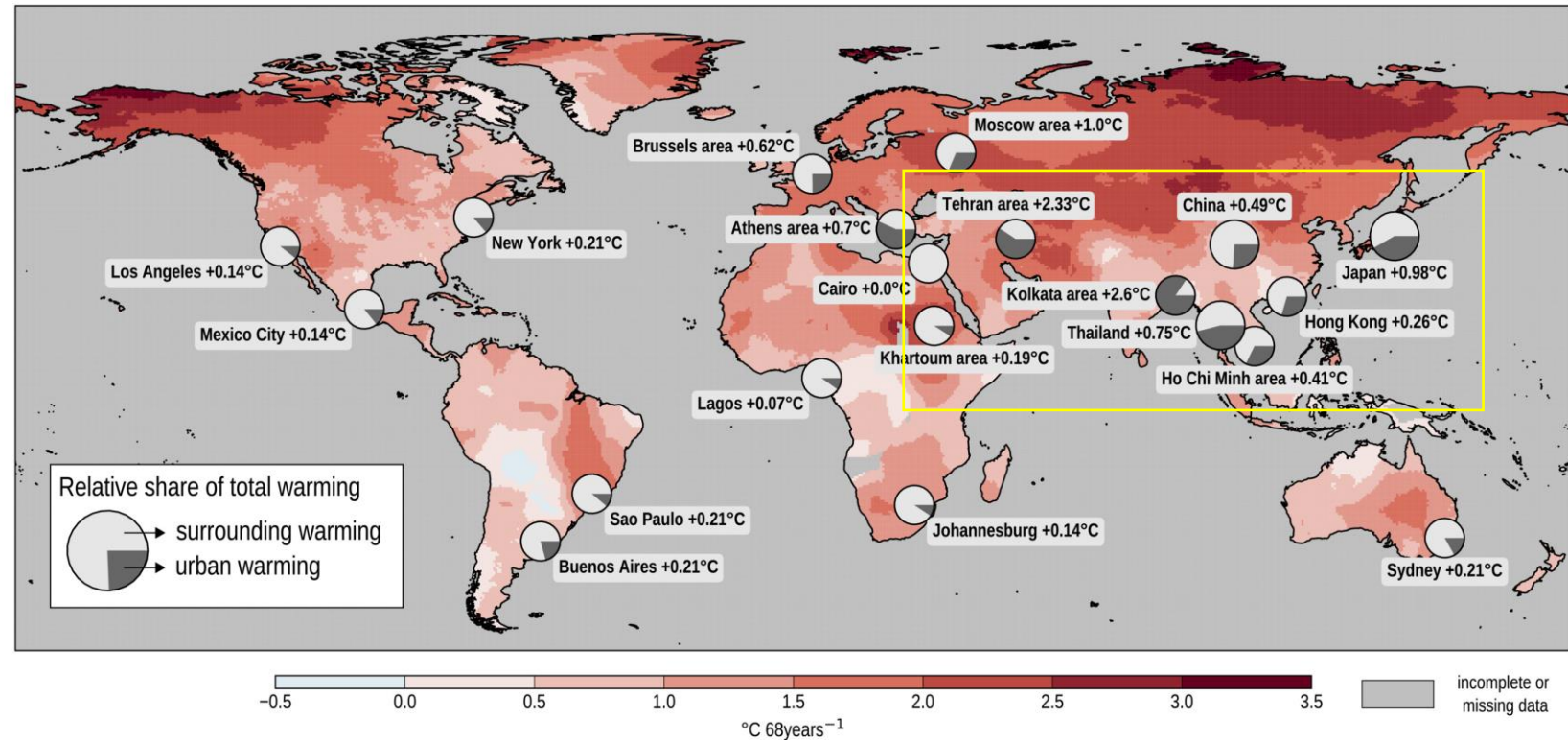
 Annual-mean daily minimum **temperature is more affected** by urbanization than annual-mean daily maximum temperature (*very high confidence*).

 Urbanization **has exacerbated** changes in temperature extremes in cities, in particular for nighttime extremes (*high confidence*)

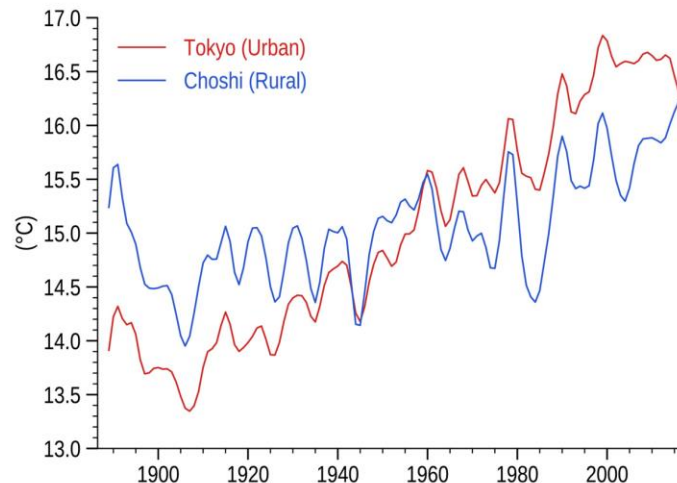
Significant contribution of urban heating in Asian cities towards overall warming trend from 1950

Singapore has **about 50%** of warming from local vs. surrounding warming

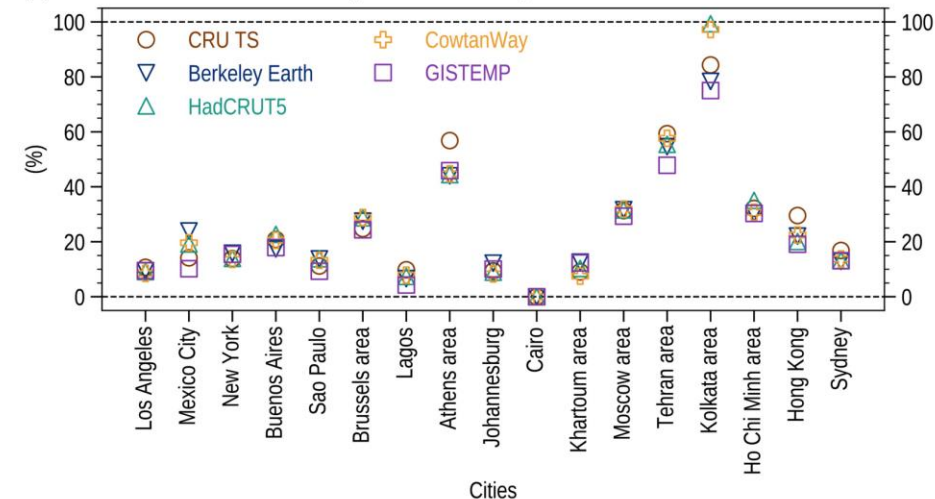
(a) Trend in global surface air temperature (CRU TS, 1950-2018)



(b) Temperature evolution Japan examples



(c) Relative share urban warming of total warming

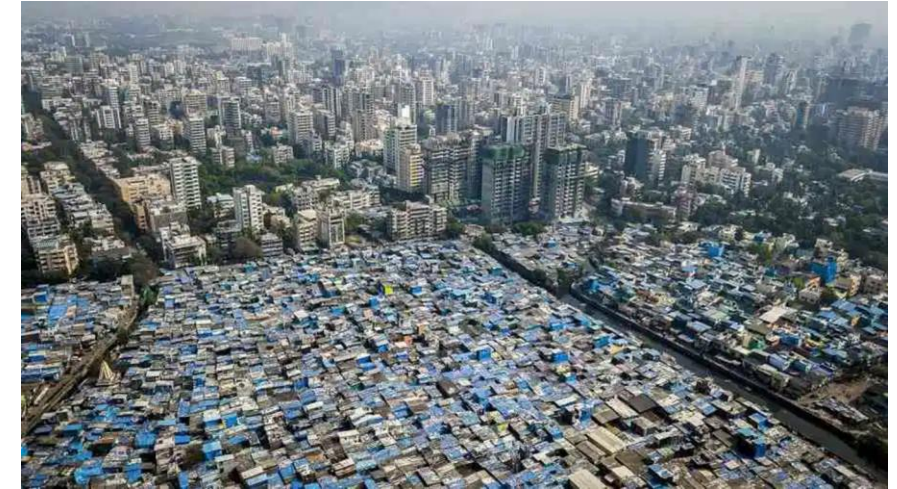
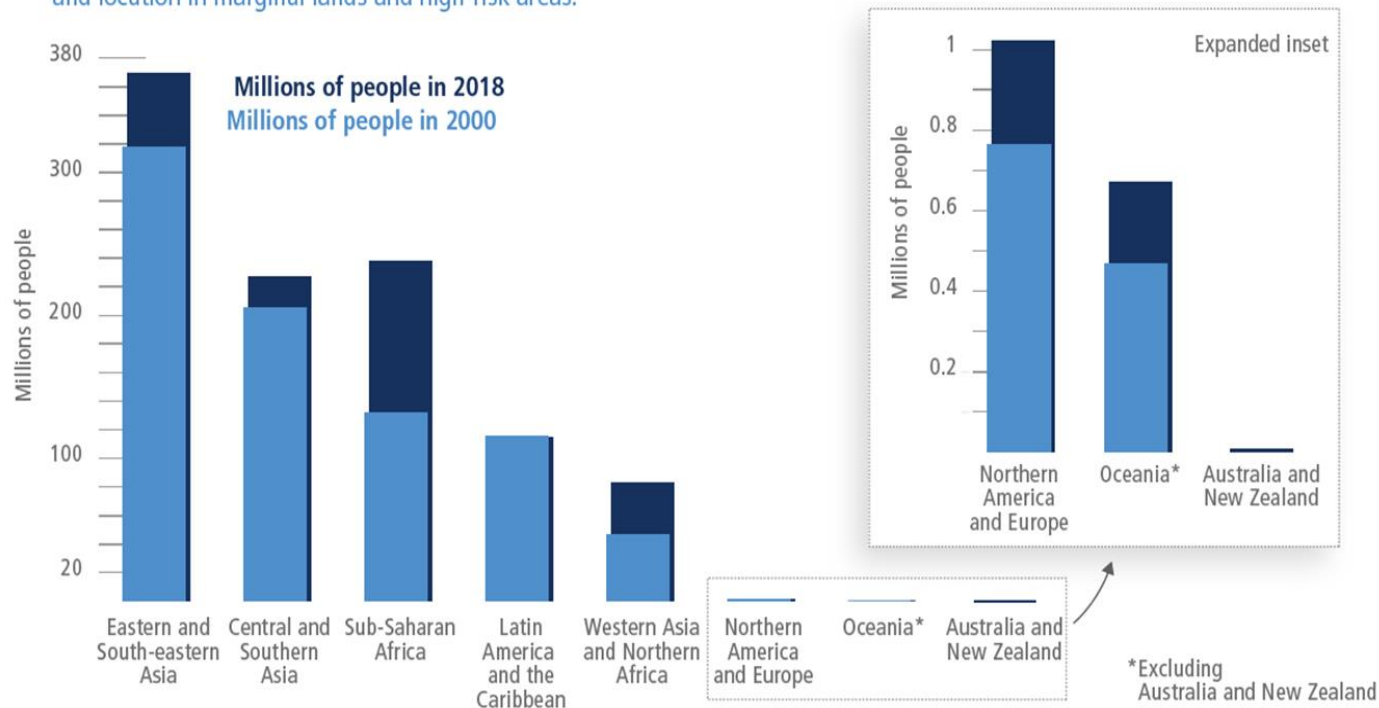


Hazard & Exposure increases, but so does Vulnerability

- Rural poverty is being replaced by **urban poverty** + **rising income inequality**

Climate change in cities and settlements

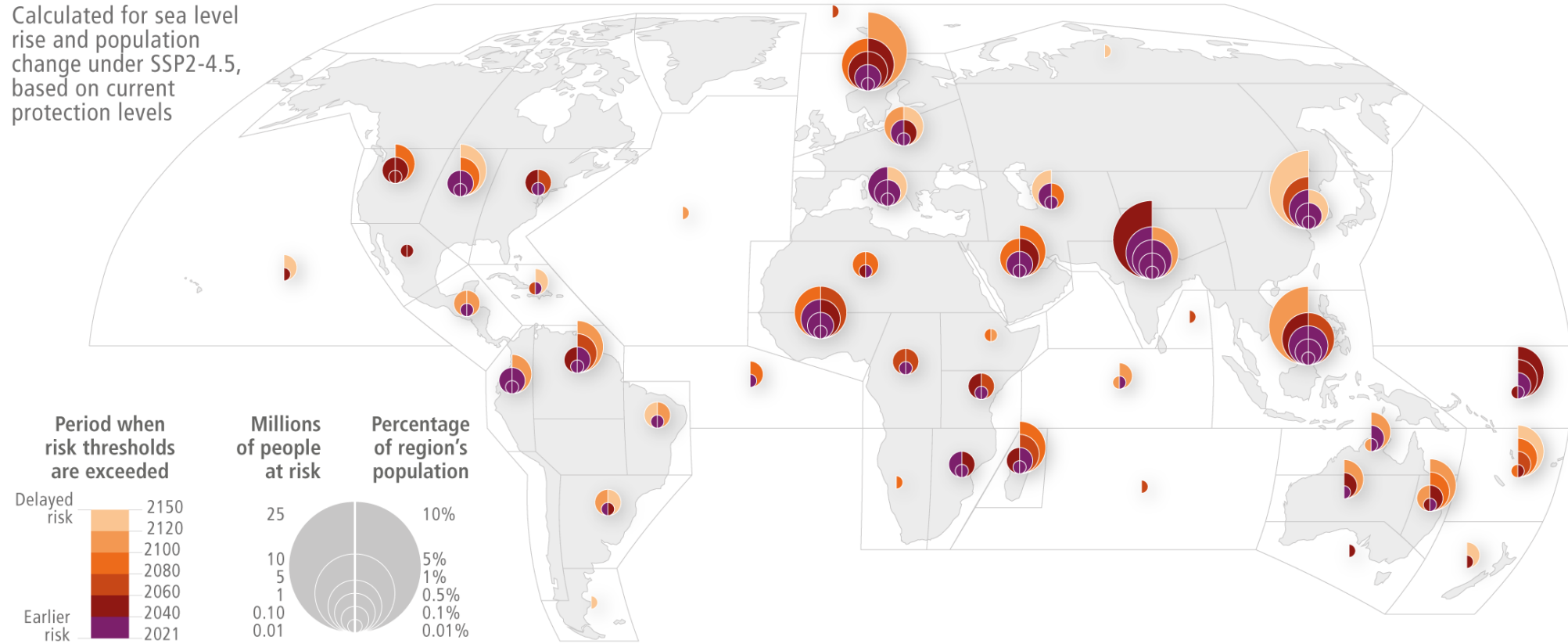
(a) Urban poor populations residing in informal settlements are highly vulnerable to climate hazards given their housing characteristics and location in marginal lands and high-risk areas.



Future risks – not just on “land”

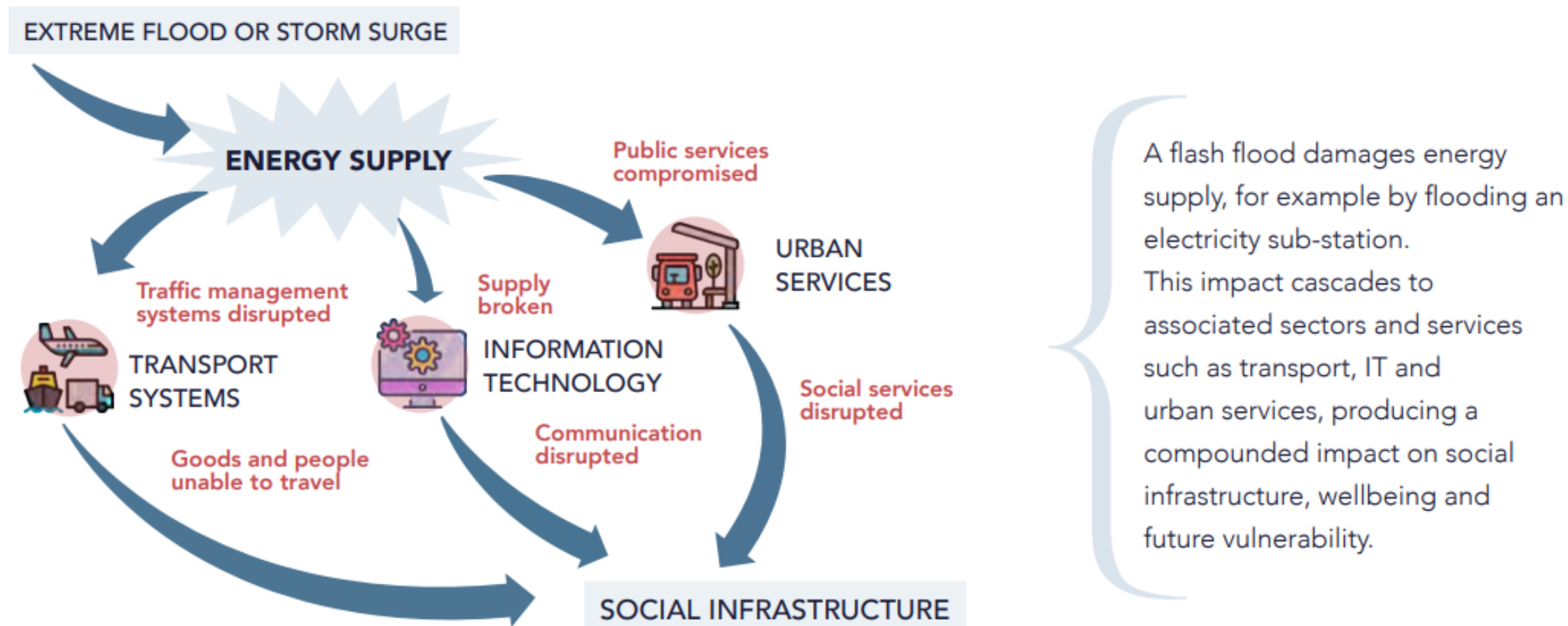
(c) Projected number of people at risk of a 100-year coastal flood.

Calculated for sea level rise and population change under SSP2-4.5, based on current protection levels

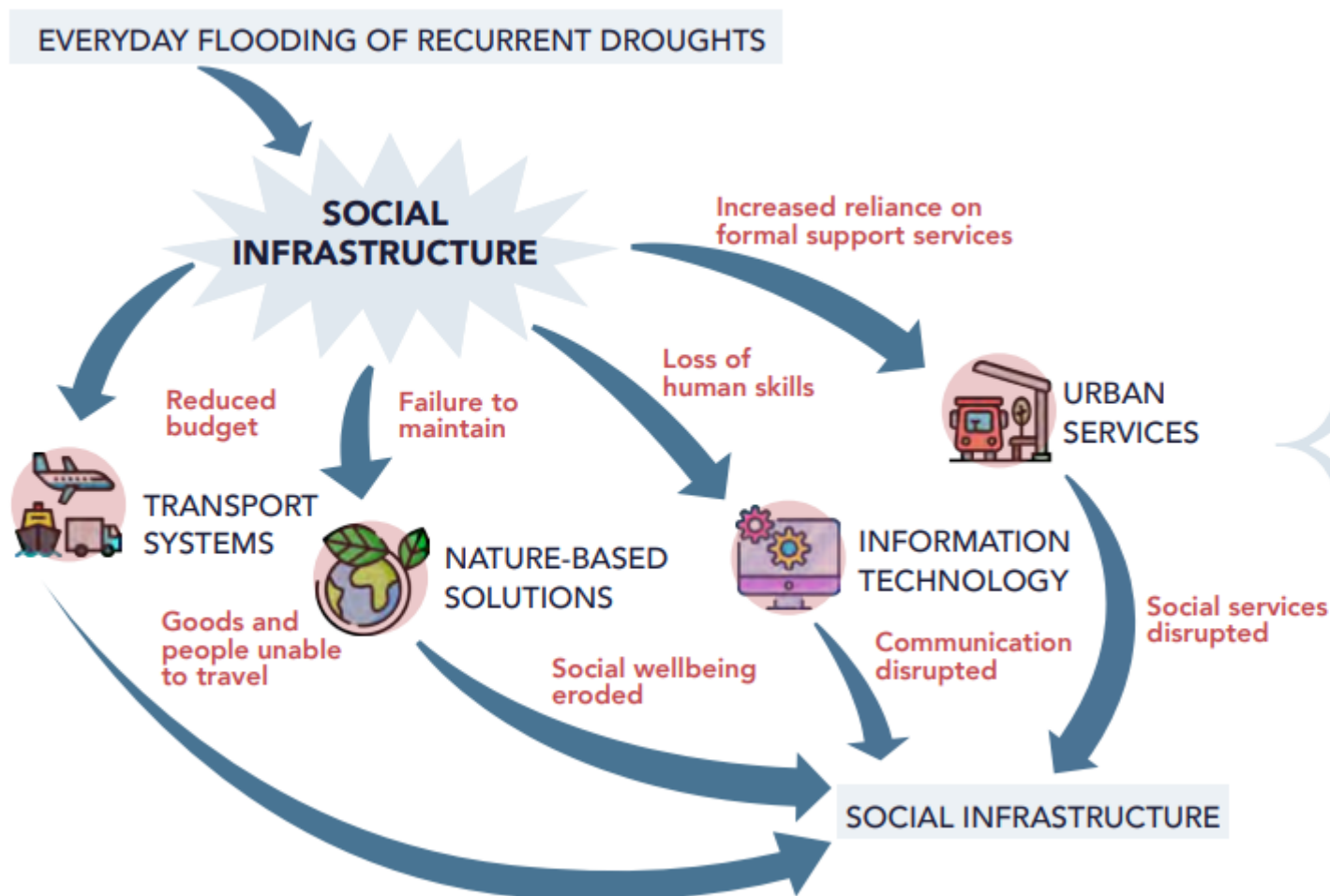


Urban coastal risks from sea level rise and coastal flooding

Compound and cascading risks emerge



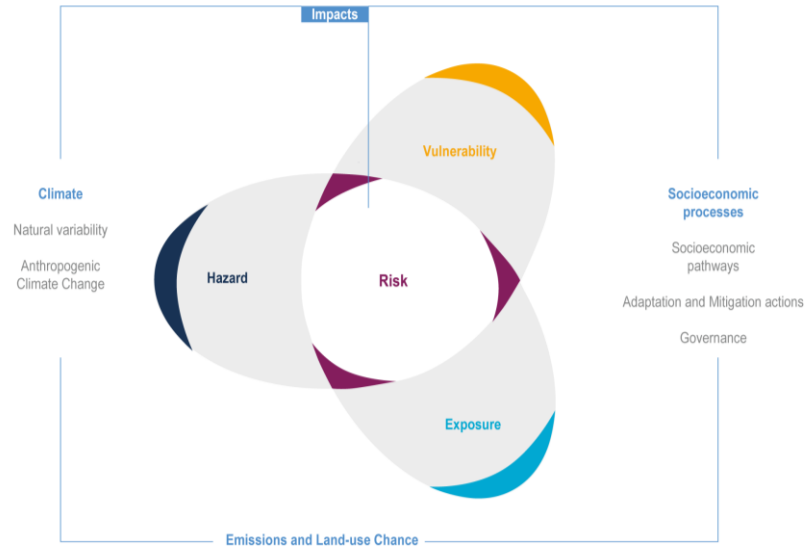
Compound and cascading risks emerge



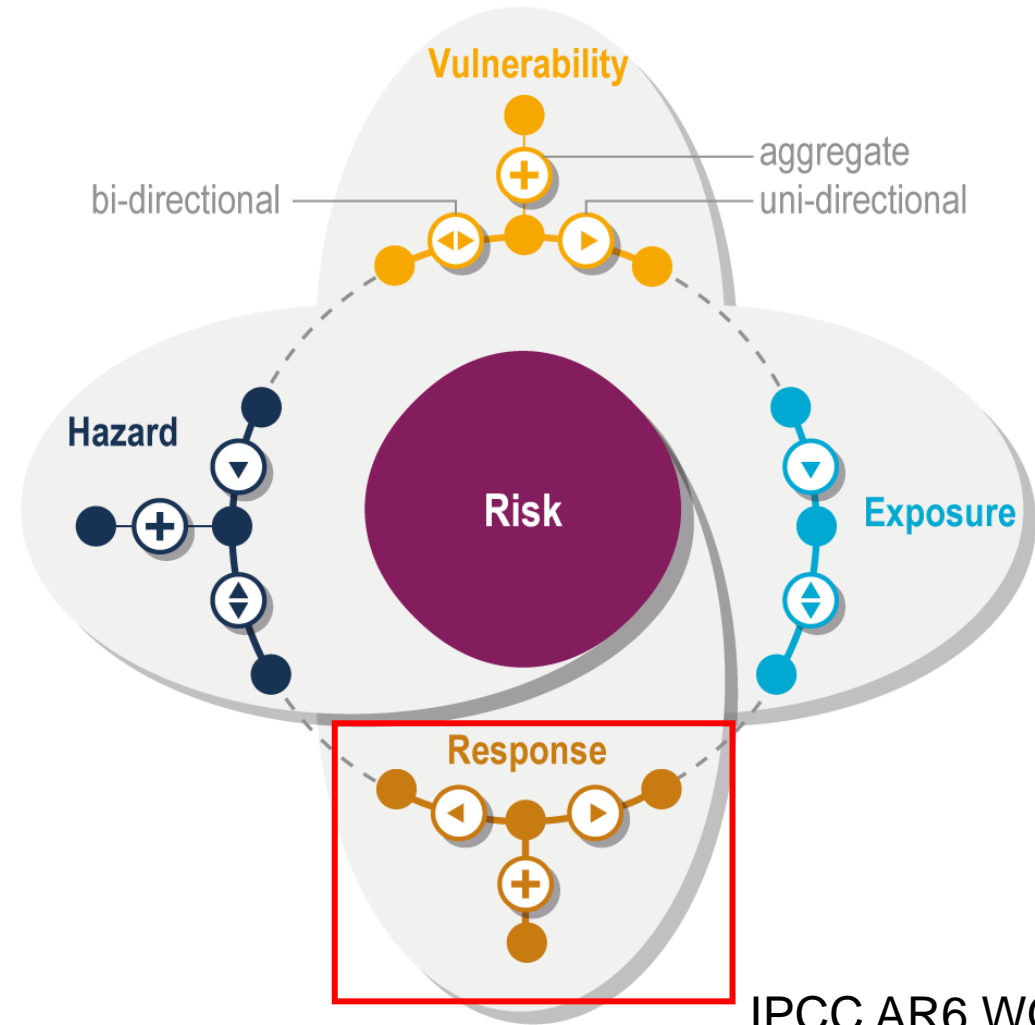
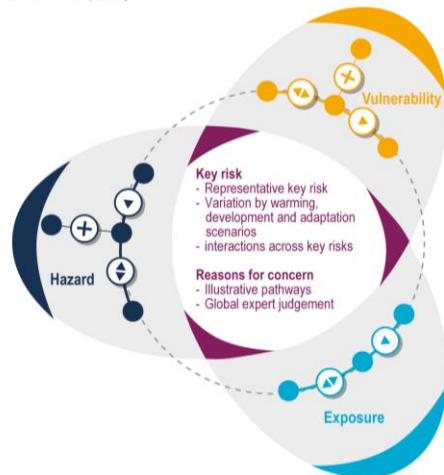
Chronic climate impacts such as everyday flooding put pressure on social infrastructure over time. Strained livelihoods, health and education services challenge city budgets and place additional demands on formal services. These impacts place further pressure on already constrained urban social infrastructure generating vulnerability.

Conceptual evolution of risk (per IPCC)

(a) The AR5 risk graphic



(b) AR6 additions: response risk and complexity



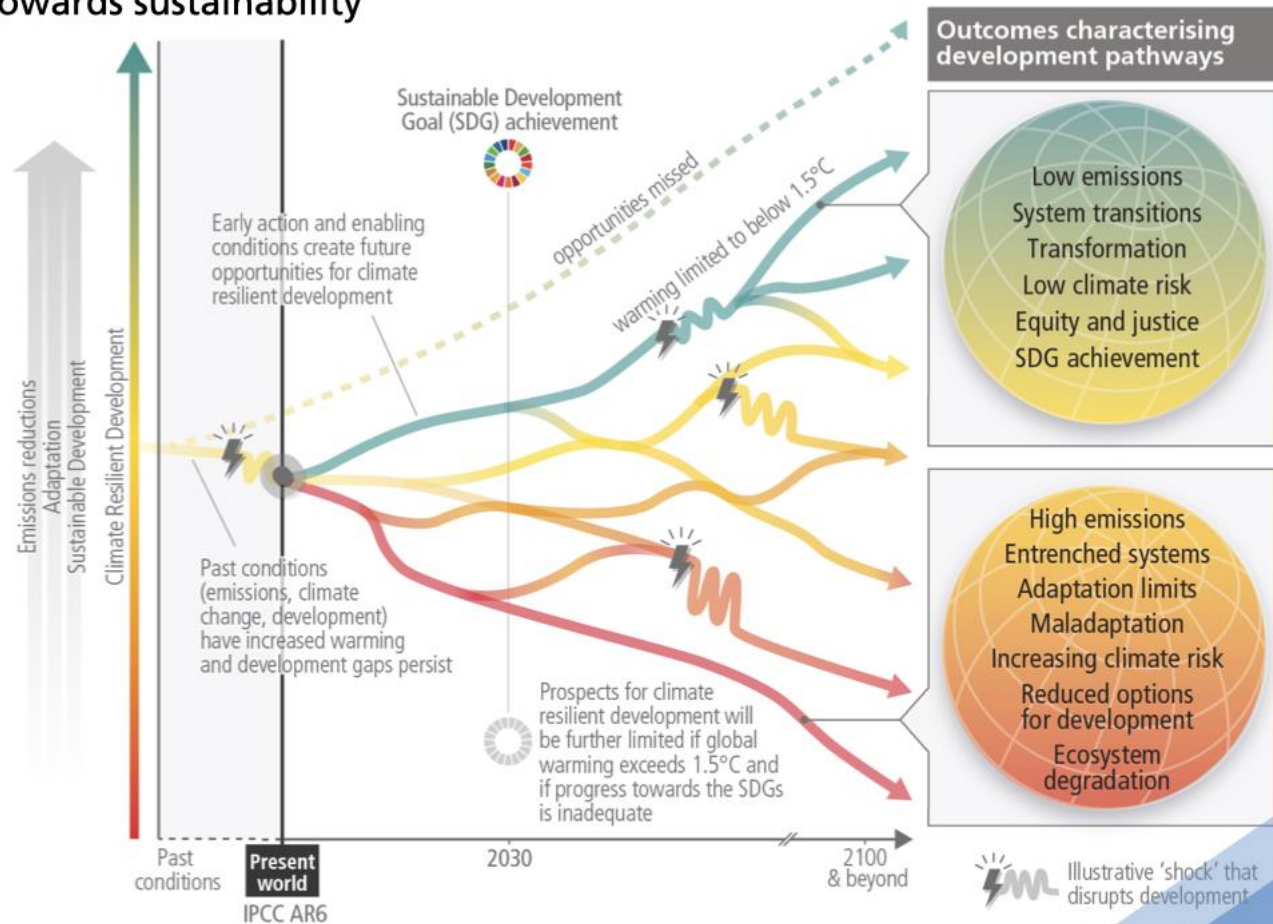
A science-based,
policy-relevant
solution

“Best” way to
reduce urban
climate risk?

Climate resilient
Development
(CRD)

There is a rapidly narrowing window of opportunity to enable climate resilient development

Multiple interacting choices and actions can shift development pathways towards sustainability



IPCC AR6 SYR Figure SPM 6

CRD utilises **coordinated and inclusive** approaches to lessen climate risk

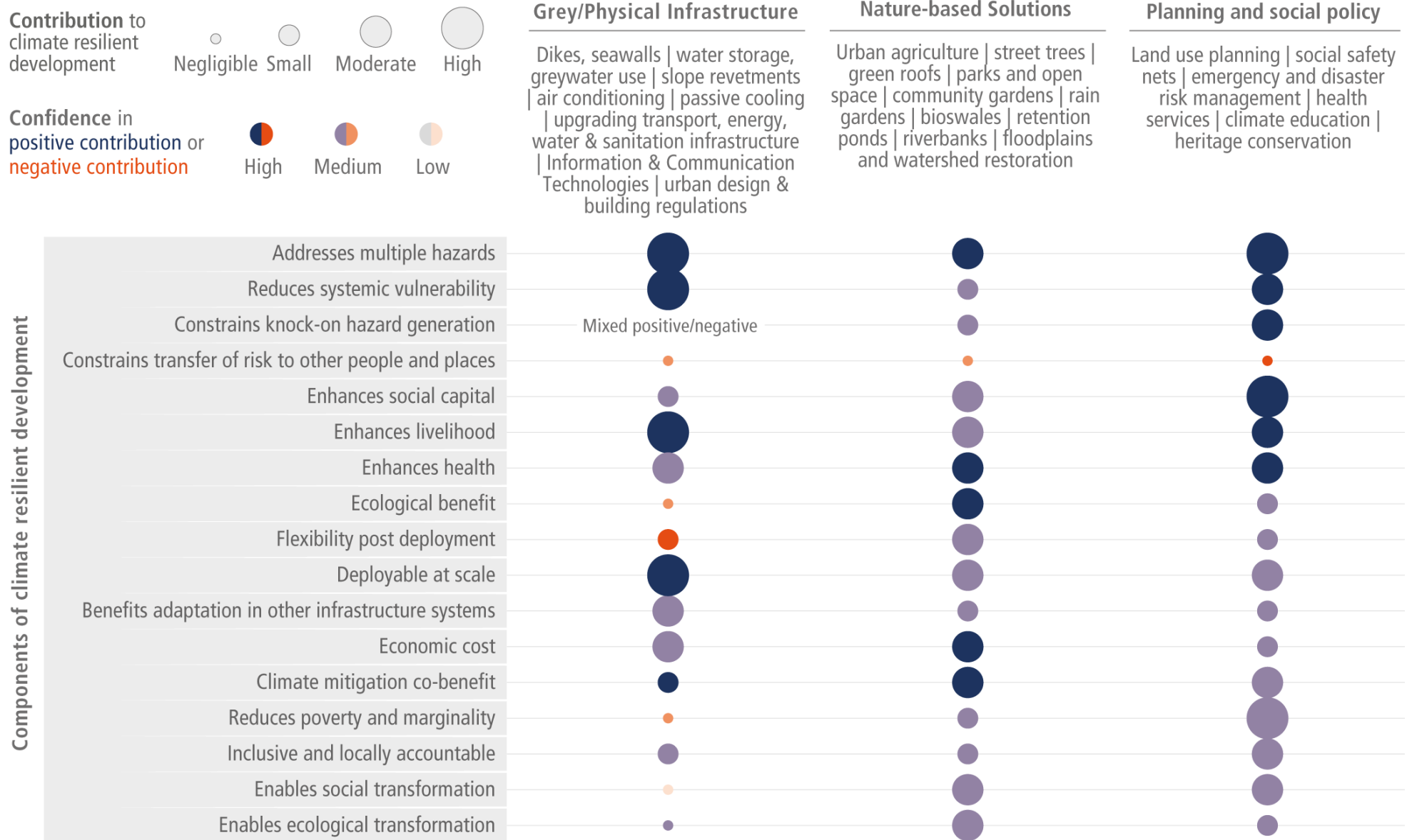
Implementing **existing** data, information & policies in reducing climate hazard

Reduce occurrence of **maladaptation**

Financing these approaches is critical

(d) Contributions of urban adaptation options to climate resilient development.

Nature-based solutions and social policy as innovative domains of adaptation show how some of the limitations of grey infrastructure can be mediated. A mixture of the three categories has considerable future scope in adaptation strategies and building climate resilience in cities and settlements.



Integrating adaptation with mitigation

	Urban Green and Blue Infrastructure	Mitigation Benefits	Adaptation Co-benefits	SDG Linkages
Urban Forests		<ul style="list-style-type: none"> Sequester and Store Carbon (High) Reduce Building Energy Use (High) Reduce Municipal Water Use (High) Facilitate Active Mobility (Medium) 	<ul style="list-style-type: none"> Reduce Heat Stress (Medium) Mitigate Flooding (Medium) Improve Health (Medium) Promote Biodiversity (High) 	
Street Trees		<ul style="list-style-type: none"> Sequester and Store Carbon (Medium) Reduce Building Energy Use (High) Reduce Municipal Water Use (High) Facilitate Active Mobility (Medium) 	<ul style="list-style-type: none"> Reduce Heat Stress (Medium) Mitigate Flooding (Medium) Improve Health (Medium) Promote Biodiversity (High) 	
Green Roofs		<ul style="list-style-type: none"> Sequester and Store Carbon (Low) Reduce Building Energy Use (High) Reduce Municipal Water Use (High) Facilitate Active Mobility (Low) 	<ul style="list-style-type: none"> Reduce Heat Stress (Medium) Mitigate Flooding (Medium) Improve Health (Medium) Promote Biodiversity (High) 	

Key Adaptation Co-benefits

- Reduce Heat Stress
- Mitigate Flooding
- Improve Health
- Improve Air Quality
- Promote Biodiversity

Key Mitigation Benefits

- Sequester and Store Carbon
- Reduce Building Energy Use
- Reduce Municipal Water Use
- Facilitate Active Mobility

Green Walls		<ul style="list-style-type: none"> Sequester and Store Carbon (Low) Reduce Building Energy Use (High) Reduce Municipal Water Use (High) Facilitate Active Mobility (Medium) 	<ul style="list-style-type: none"> Reduce Heat Stress (Medium) Mitigate Flooding (Medium) Improve Health (Medium) Promote Biodiversity (High) 	
Blue Spaces		<ul style="list-style-type: none"> Sequester and Store Carbon (Low) Reduce Building Energy Use (High) Reduce Municipal Water Use (High) Facilitate Active Mobility (Medium) 	<ul style="list-style-type: none"> Reduce Heat Stress (Medium) Mitigate Flooding (Medium) Improve Health (Medium) Promote Biodiversity (High) 	
Greenways		<ul style="list-style-type: none"> Sequester and Store Carbon (Low) Reduce Building Energy Use (High) Reduce Municipal Water Use (High) Facilitate Active Mobility (High) 	<ul style="list-style-type: none"> Reduce Heat Stress (Medium) Mitigate Flooding (Medium) Improve Health (Medium) Promote Biodiversity (High) 	
Urban Agriculture		<ul style="list-style-type: none"> Sequester and Store Carbon (Low) Reduce Building Energy Use (High) Reduce Municipal Water Use (High) Facilitate Active Mobility (Low) 	<ul style="list-style-type: none"> Reduce Heat Stress (Medium) Mitigate Flooding (Medium) Improve Health (Medium) Promote Biodiversity (High) 	

E.g. urban green and blue infrastructure (IPCC AR6 WGIII Chapter 8)

From AR6 to AR7

- Need for actionable solutions for cities – especially on critical gaps on policy and urban finance
- Special Report on Climate Change and Cities
 - Scoping meeting (early 2024)
 - Approval of report outline and structure (mid-late 2024)
 - Selection of authors thereafter



Two takeaways

- Urban areas have been – and will continue to be – the foci of many compound and cascading climate impacts and risks
 - Inadvertent risks arising from interactions between two complex systems
- Successful urban adaptation requires climate resilient development to occur
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Thank you!

- @winstontlchow
- winstonchow@smu.edu.sg