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Accelerating Climate Resilient Development in Urban Areas

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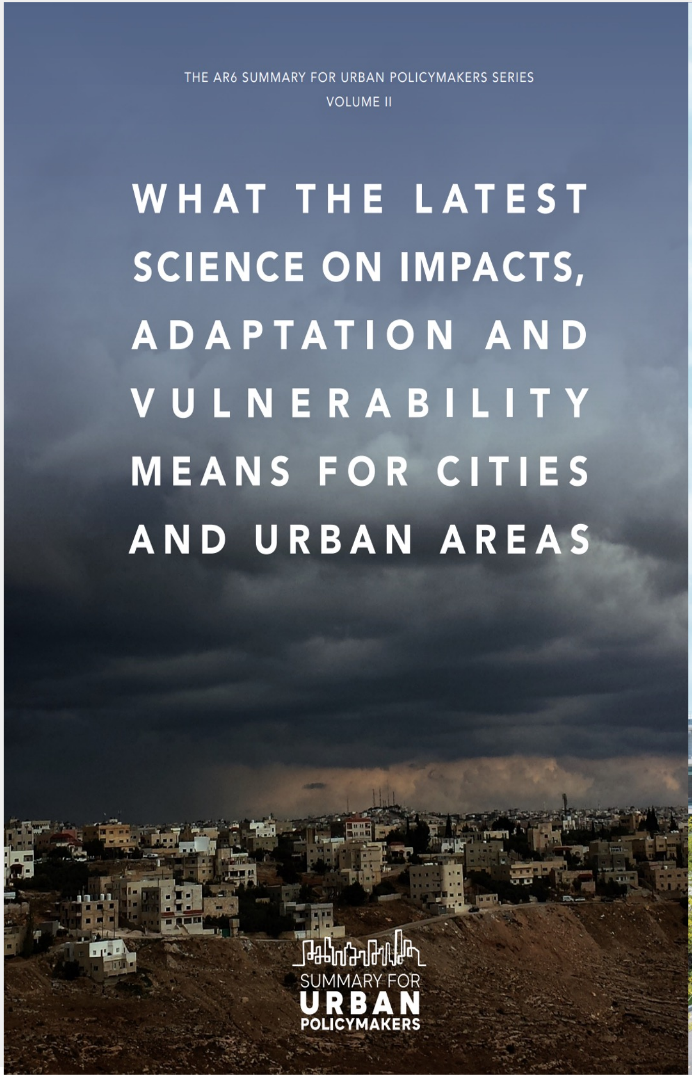

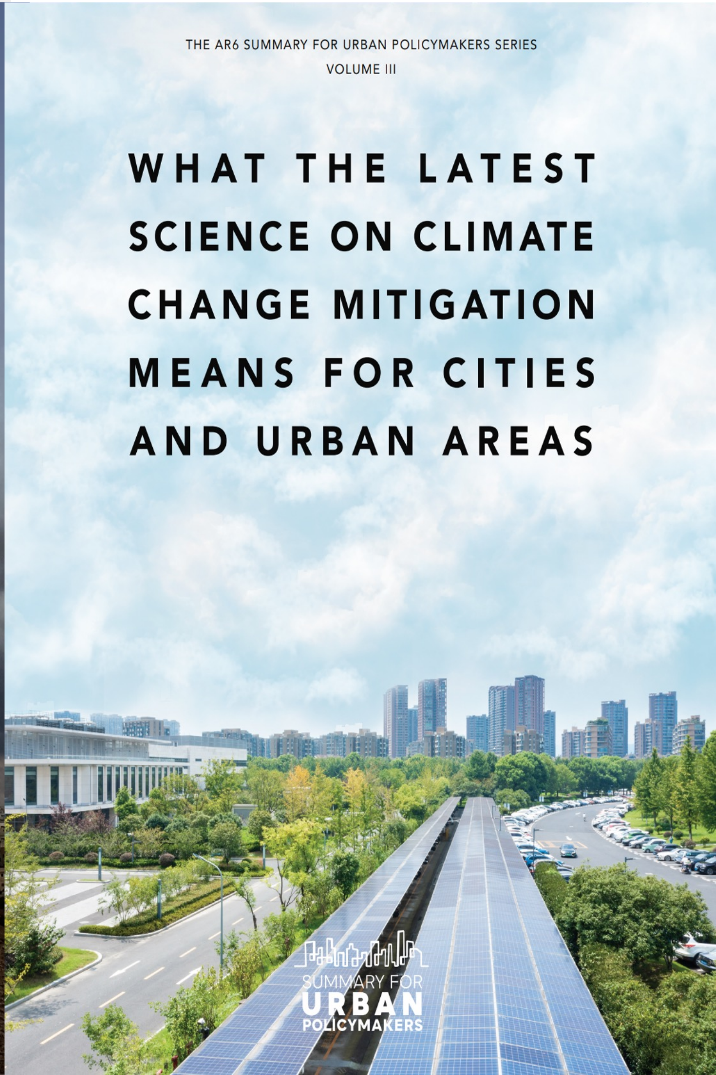

Climate Extremes will become more widespread and pronounced with every increment of warming

iihs
INDIAN INSTITUTE FOR HUMAN SETTLEMENTS

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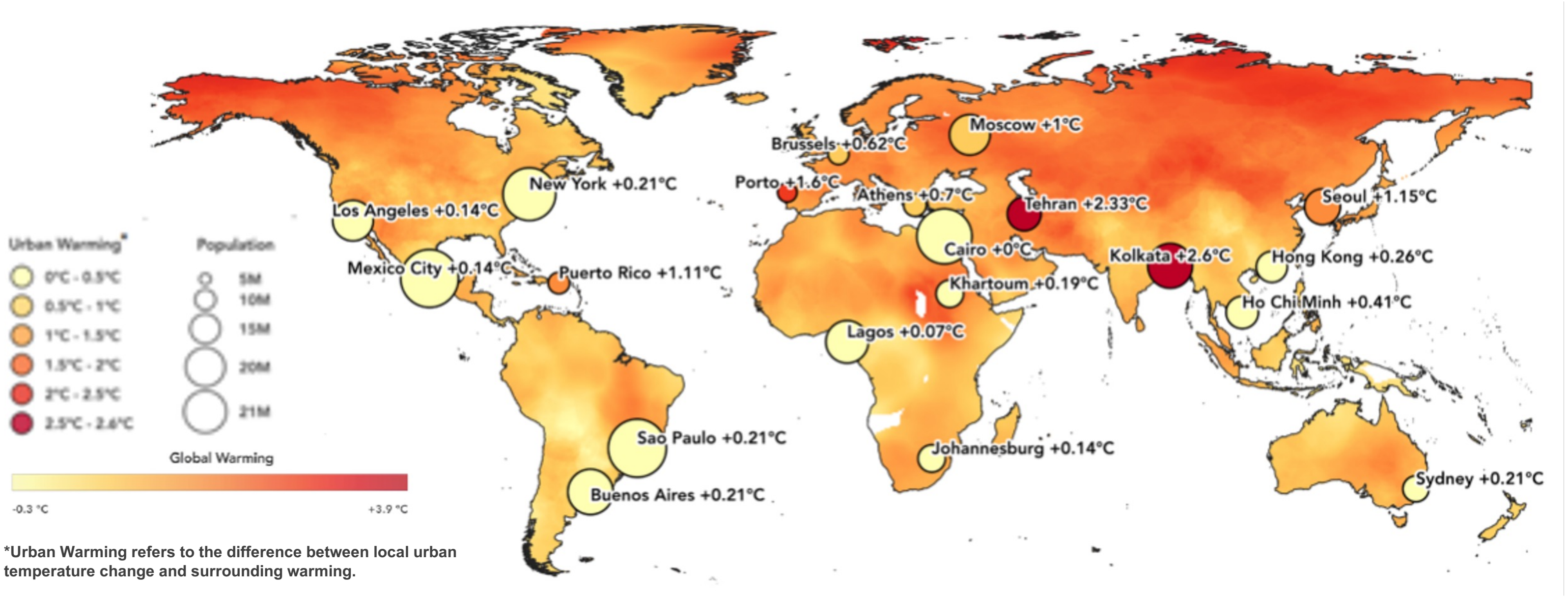
At current increases of global surface temperature (+1.1°C), warming is amplified in cities. Most cities and urban areas will experience increases in local temperature of +1.5°C and 2°C earlier than other areas.

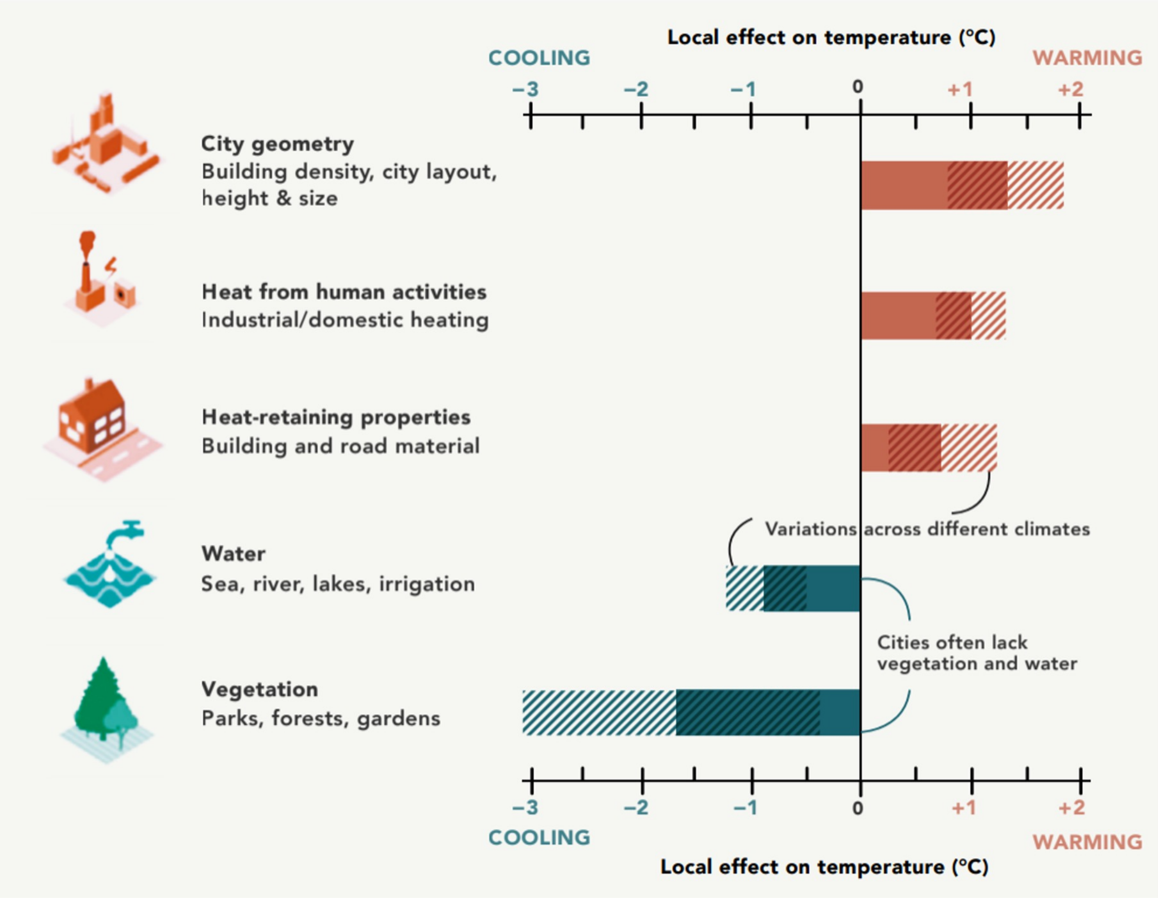
Figure 2: Past trends in global surface air temperature (1958-2018) with cities reporting significant temperature increases.



*Urban Warming refers to the difference between local urban temperature change and surrounding warming.

Source: Change in the annual mean surface air temperature over the period 1958-2018 based on the local linear trend retrieved from CRU TS (°C per 68 years). This map has been amended from IPCC 2021, Climate Change 2021: The Physical Science Basis, Chapter 10: Linking Global to Regional Climate Change; United Nations, Department of Economic and Social Affairs, Population Division (2018); World Urbanization Prospects: The 2018 Revision, Online Edition.

Heat Stress in Cities



The combination of future urbanisation and frequent extreme climate events, such as heatwaves, will exacerbate heat stress in cities.

Image source: IPCC AR6 SYR

Precipitation extremes: Drought & Flooding

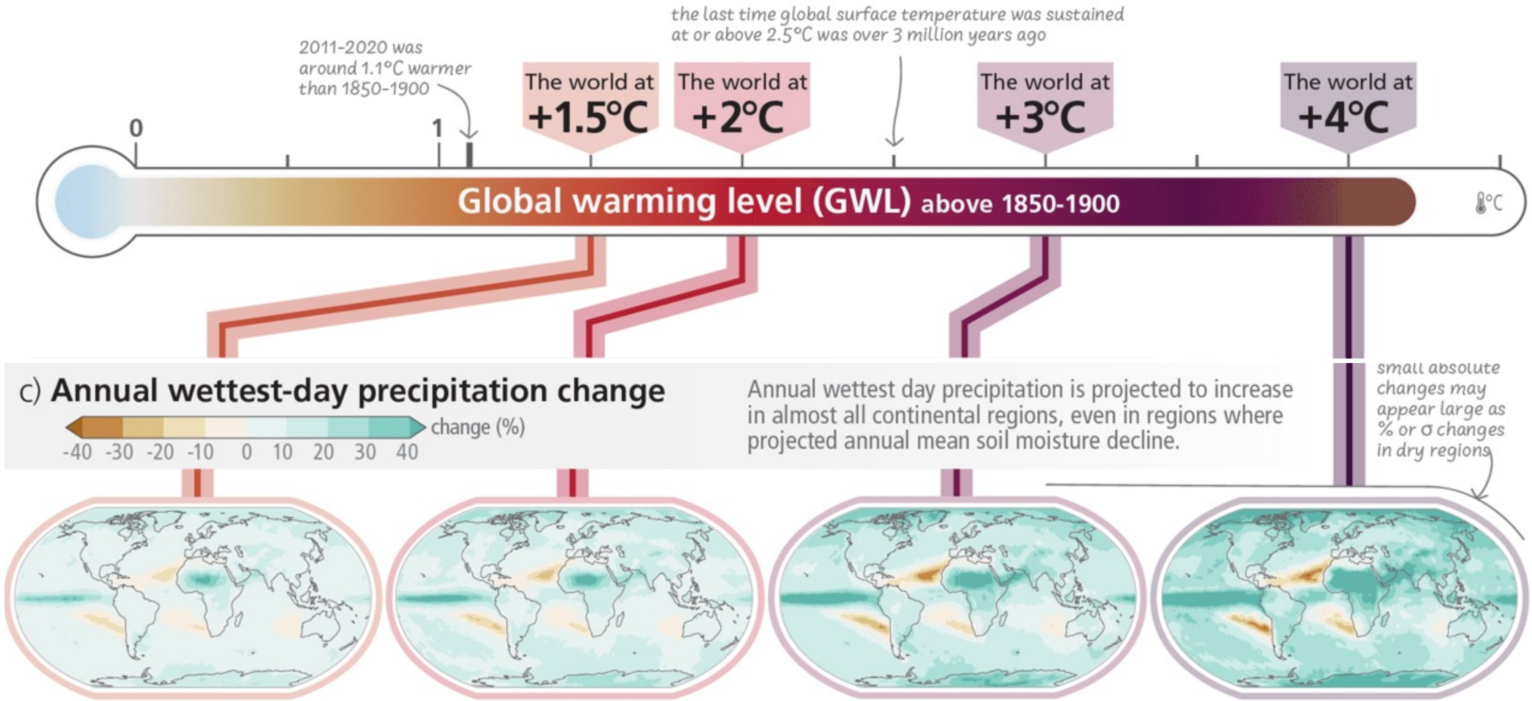


Image source: IPCC AR6 SYR

Dharga Town, Sri Lanka

Heavy rainfall events are more intense and more frequent in a warming world, and runoff is amplified by urbanisation. **Heavy rain events can flood buildings, roadways, subway tunnels, and farmlands. Heavy precipitation may overwhelm city transportation and storm water drainage systems, which are typically not designed for climate-induced extreme events.**

Image credits: Hafiz Issadeen

Food scarcity & Famine

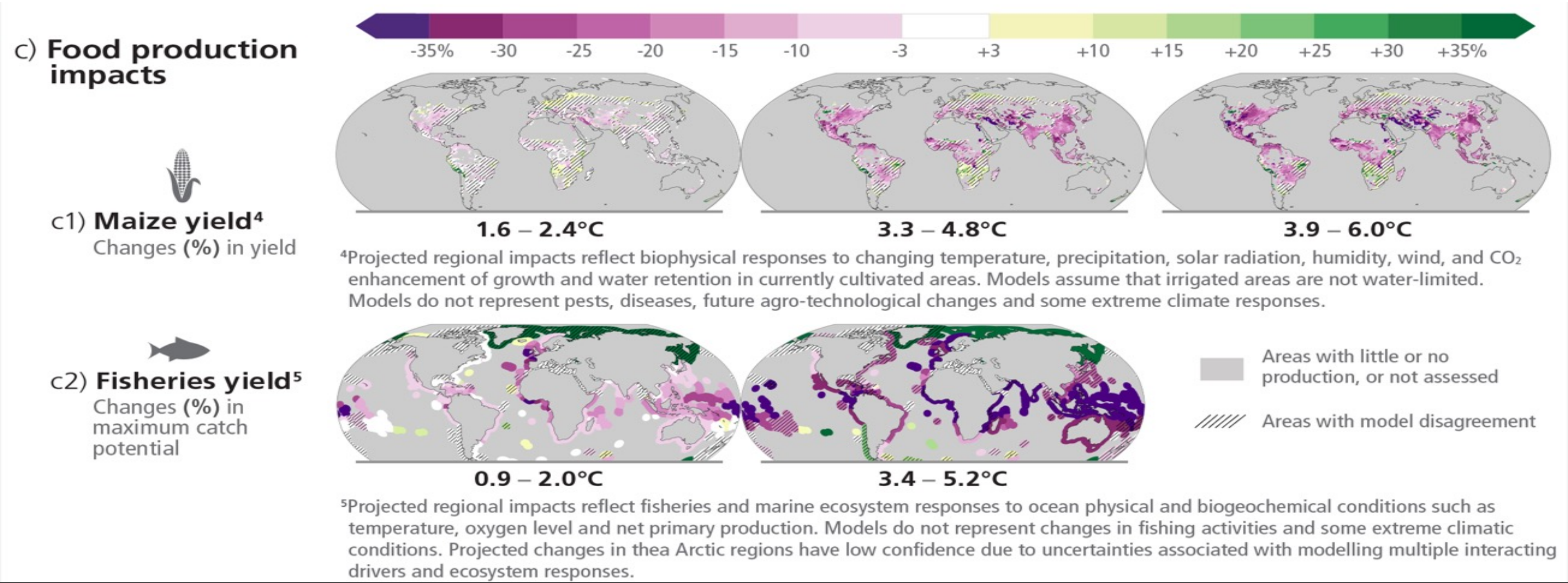
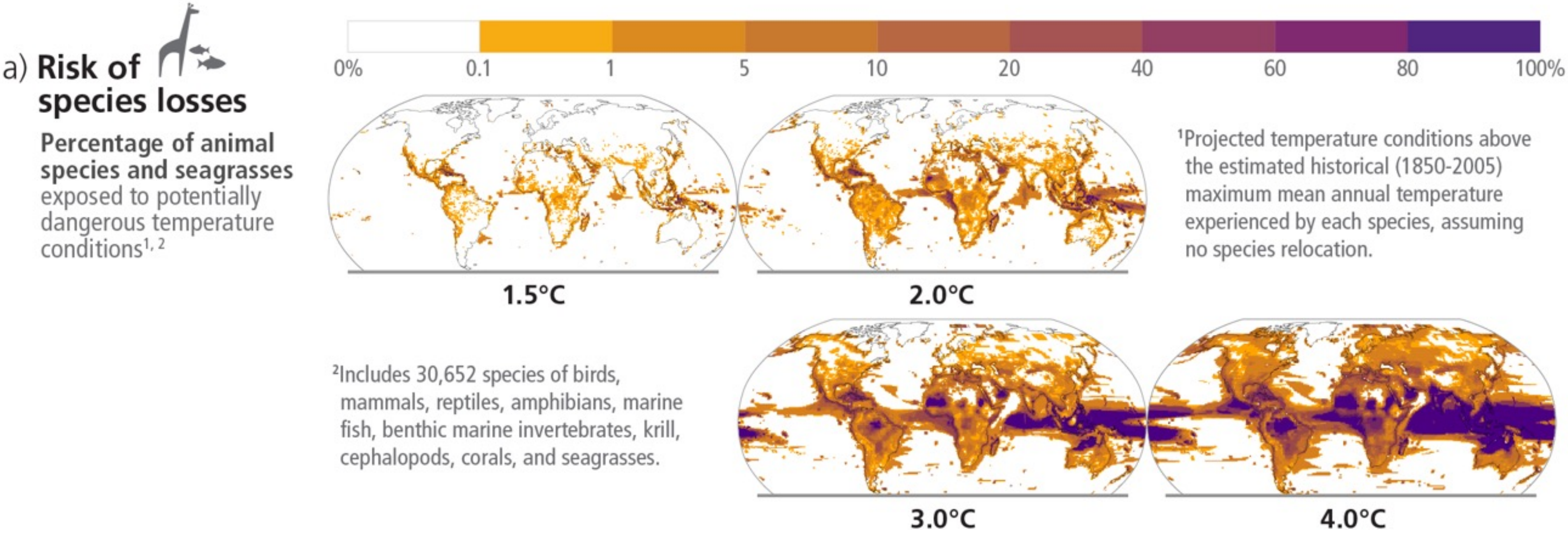


Image source: IPCC AR6 SYR

Species Loss

Examples of impacts without additional adaptation



Tokyo, Japan

Why is Systemic Risk Growing so Rapidly?

Image credits: Victor Deweerdt / Unsplash

Everything is connected in an urban world.

In a world with over 4 billion urban residents; cities and towns, the economy, and human societies are strongly coupled with the climate system and ecosystems.

A change in one system impacts the others.

Figure 1: Climate, ecosystems and human society are coupled systems key to climate resilient development

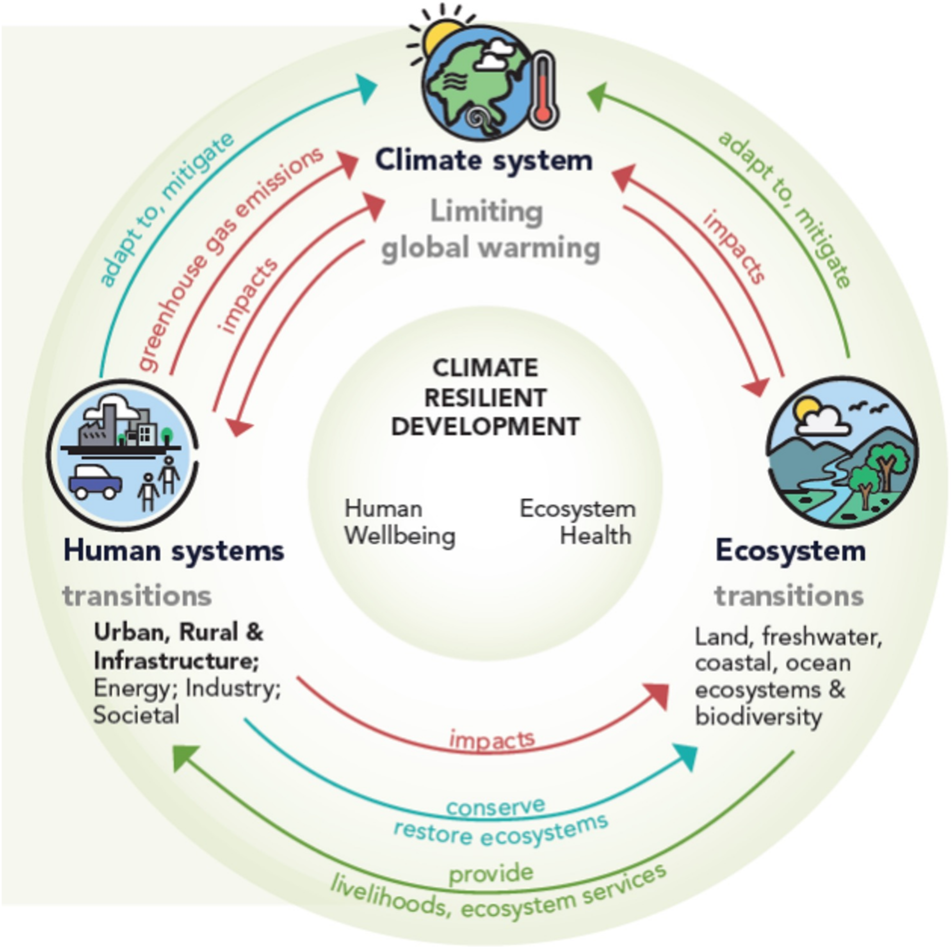
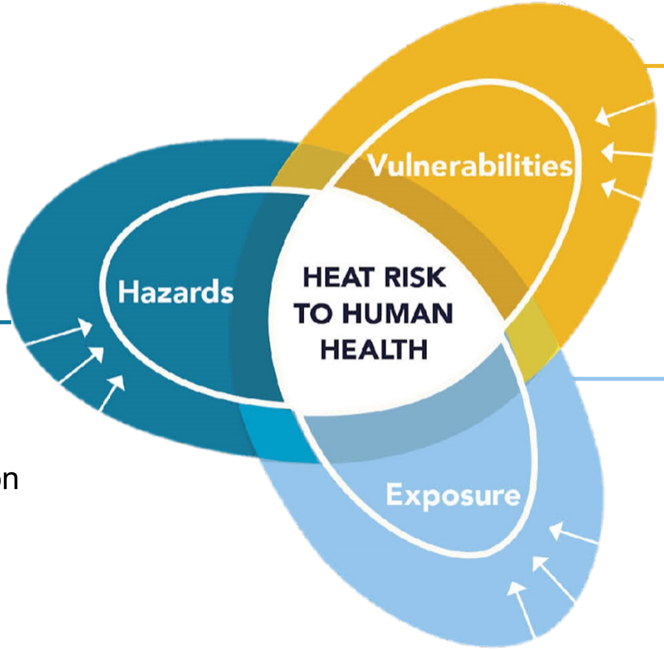


Figure Source: A re-interpretation of data underlying the Figure SPM.1, Summary for Policymakers, IPCC AR6 WGII

Climate risk is exacerbated in urban areas by the interaction of climate hazards; exposure due to densely populated cities, inadequate buildings and basic services, and poor infrastructure; and underlying vulnerability, urban poverty, inequality and uneven adaptive capacities.

Figure 2: Risk is a function of hazards, exposures, vulnerabilities, and adaptive capacities; all of which are mediated by mitigation and adaptation responses. Figure illustrates an example of heat risk.



VULNERABILITIES REDUCTION

- Livelihood diversification
- Insurance
- Public health infrastructure

HAZARD REDUCTION

- Climate mitigation
- Reduced air pollution

EXPOSURE REDUCTION

- Increased public green spaces
- Altered outdoor work times
- Active and passive cooling
- Early warning systems
- Cooling shelters

Figure Source: Derived from IPCC AR6 WGII, Chapter 1, Figure1.5(b)

The nature of climate-related risks is changing in an urbanising world

They are becoming increasingly systemic, simultaneous, and affect multiple locations across different timescales, leading to cascading and compounding impacts.

Figure 3: Climate impacts cascade through infrastructure across sectors

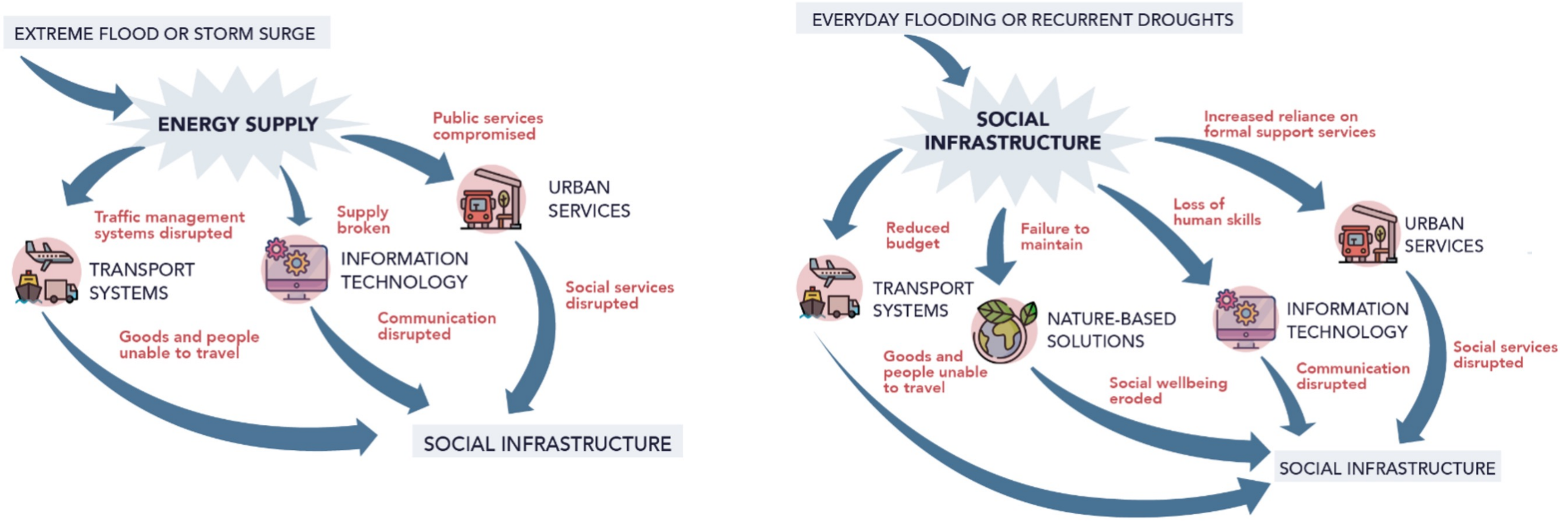


Figure Source: Derived from IPCC AR6 WGII, Chapter 6, Figure 6.2

How can we address accelerating, deepening, compounding and cascading Systemic Risk?

Alajuela, Costa Rica

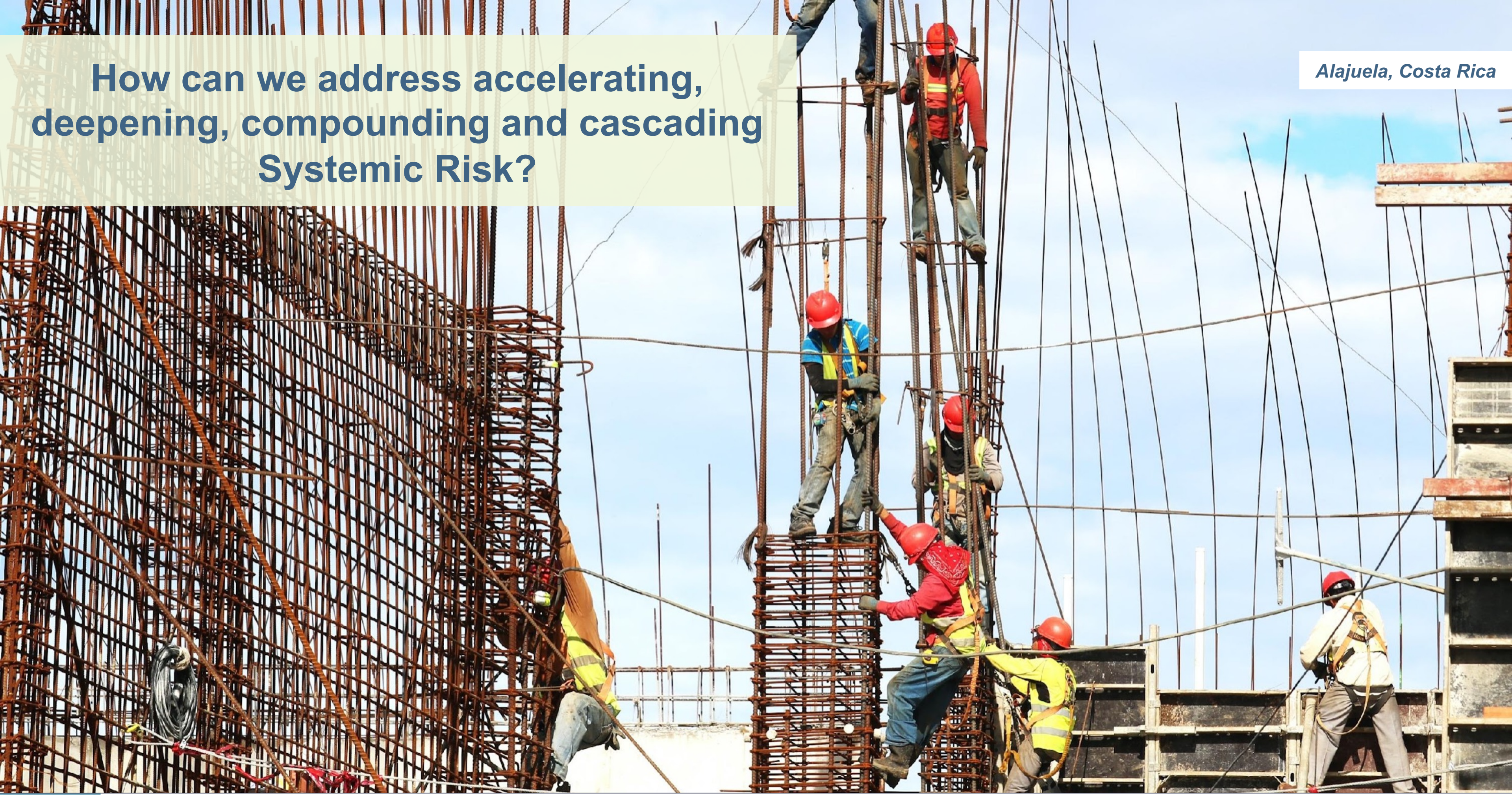


Image credits: Victor Deweerdt / Unsplash

System Transitions aka Transformation

System Transitions are key to address systemic risks to coupled human, natural and climate systems. These include five simultaneous transitions in:

- **Urban and Infrastructure systems**
- **Land, coastal, ocean and freshwater ecosystems**
- **Energy systems**
- **Industrial systems**
- **Societal choices and transitions**

Together, these transitions advance sustainable development alongside adaptation, mitigation and biodiversity conservation

Figure 5: Multidimensional feasibility of select adaptation options organized by System Transitions and Representative Key Risks (RKRs)

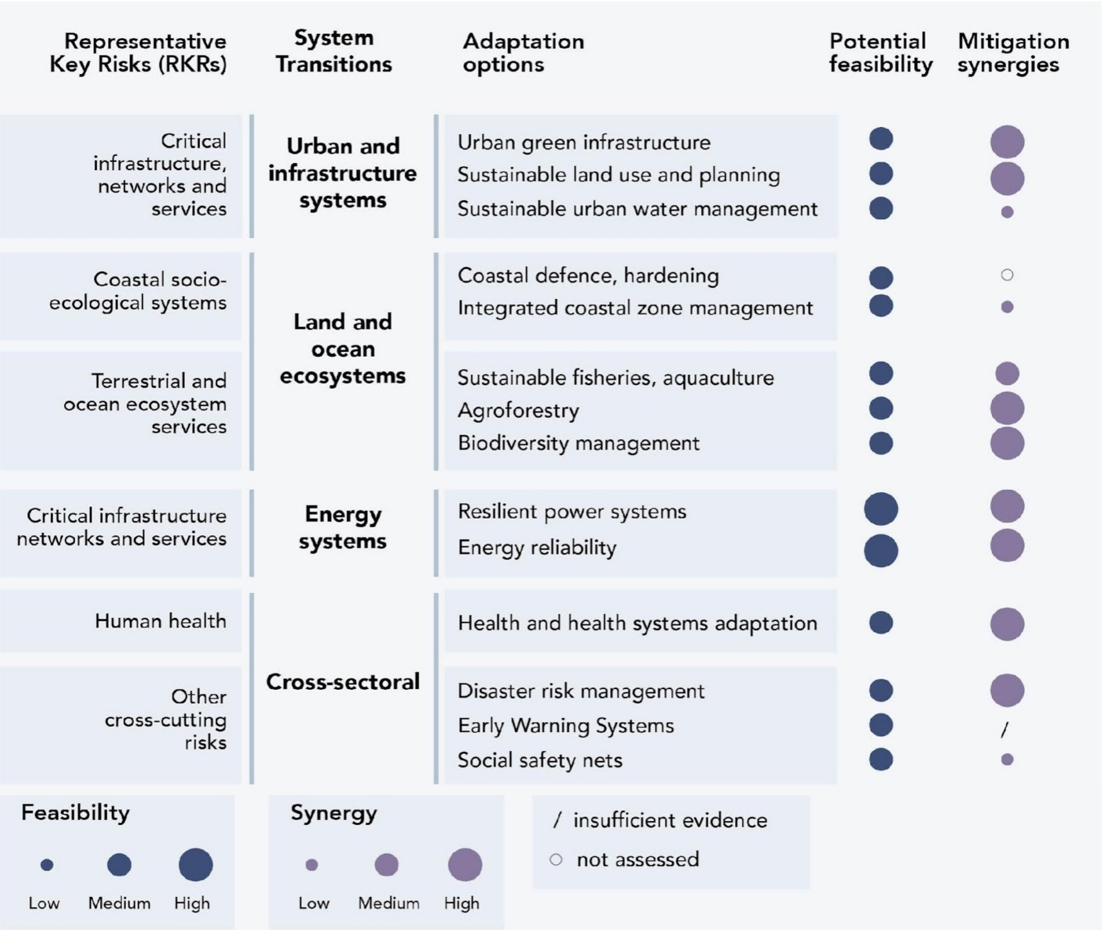


Figure Source: Derived from IPCC AR6 WGII, Summary for Policymakers, Figure SPM.4(a)

A rich & diverse set of feasible Response Options

There are **multiple feasible mitigation options and synergies between mitigation action and sustainable development** across key urban sectors and approaches such as urban planning.

Among these, energy efficiency and expanding renewable energy have multiple sustainable development benefits.

Expanding clean energy and public transport use can improve SDG outcomes on health, employment, energy security and equity.

Figure 3: Overall feasibility of mitigation options and synergies and trade-offs between sectoral mitigation options and the SDGs

Sector	Mitigation Response Options	Overall Feasibility	1	2	3	4	5	6	7	8	9	10	11	12	14	15
Energy	Solar Energy	High	+	★	+			★	+	+	+		+	★		★
Energy	Wind energy	Medium	+	★	+			+	+	+	+		+	★	★	★
Energy	Geothermal	Low	+		★			★	+		+		+			
Energy	Energy storage for low-carbon grids	Low														
Energy	Demand side mitigation	Medium	+	+	+		+	+	★	★	+	+	+			
Energy	System integration	Medium														
Urban	Urban land use and spatial planning	Medium	+	★	+	+	+	+	+	+	+	★	+	★	★	★
Urban	Electrification of the urban energy system	High	+	★	+	+	+	+	+	+	+	+	+	★	+	★
Urban	District heating and cooling networks	Medium	+	−	+				+	+	+		+	+		+
Urban	Urban green and blue infrastructure	High	+	+	+	+		+	+	+	+	★	+	+	+	+
Urban	Waste prevention, minimization and management	Medium	+	+	★			+		★	+					+
Urban	Integrating sectors, strategies and innovations	Medium	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Building	Building design and performance	Low	+	+	+			+	+	★		+	+	+		+
Building	Change in construction methods and circular economy	Medium			+			★	+	★	+		+	+		
Building	Envelope improvement	Low	★	+	★	+		+	+	★	★	★	+	+		
Building	Heating, ventilation and air conditioning (HVAC)	Low	★	+	+			+	+		★	★	+	+		
Building	Efficient Appliances	Medium	★	+	+	+	+	+	+	★	−	★	+	★		+
Building	Change in construction materials	Low			+			★	+	★	+			+	+	
Building	Demand Side management (active management operation, digitalization and flexible comfort requirements)	Low	★	★	+	+	+	★	★	★	★	★	+	+		+
Building	Renewable energy production	Low	+		★	+	+		+	+	+	+	+	+		
Transport	Demand reduction and mode shift	Medium	+		+	+	+		+	+	★	+	+	+		
Transport	Biofuels for land transport, aviation, and shipping	Low		★	★				+	+	+		+		★	★
Transport	Electric vehicles for land transport	Low				★				★	+	+	★	+	★	

Relation with Sustainable Development Goals

+ Synergies
− Trade-offs
★ Synergies and trade-offs
Blanks represent no assessment

Overall Feasibility: High / Medium / Low

Figure Source: Derived from IPCC AR6 WGIII, Summary for Policymakers, SPM.8

Jakarta, Indonesia

Energy Systems Transitions

Cities and urban areas have a key role in the Energy Systems Transitions on the demand-side & supply-side

- **Compact urban form can reduce energy demand**
- **Demand management can increase energy systems flexibility to accommodate more variable renewable energy sources**

Image credits: Pradamas Gifarry / Unsplash

Industrial Systems Transitions

Cities can play an important role in the Industrial Systems Transitions through spatial planning that limits material demand; design standards, building codes, efficient material procurement; and reusing and recycling waste.

Coordinated value chains decarbonisation is necessary to reach net-zero industry CO_2 emissions.

Image credits: Jenny Parkins

Land and Ecosystems Transitions

Land use change contributes 13-21% of GHG emissions.

The Land and Ecosystems Transitions can reduce emissions and climate impacts by expanding local urban green and blue infrastructure and promoting urban farming that limits transport and food waste.

The urban land and ecosystems can also be an important carbon sink, if properly managed.

Mandaue City, Philippines

Image credits: Mark Linel Padecio / Climate Visuals Countdown

The Urban and Infrastructure System Transition can be accelerated by implementing feasible adaptation options, many with strong synergies with mitigation:

- Urban and regional planning that promote compact urbanisation and protect ecosystems
- Upgrading informal settlements by investing in accessible climate-resilient infrastructure
- Locally relevant ecosystem-based adaptation options and nature-based solutions
- Social infrastructure and services such as health, education, social safety nets, climate services, and disaster management.

Guangzhou, China

Societal Transitions

Demand-side strategies across all sectors, can reduce emissions by 40-70% by 2050.

Societal Transitions are needed to accelerate these strategies and implement the Systems Transitions.

Amsterdam, Netherlands

Image credits: sabina fratila / Unsplash

Climate Resilient Development integrates adaptation, mitigation and biodiversity conservation to advance sustainable development for all people, all places and all ecosystems

Image credits: Tobias Reich / Unsplash

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Cities and urban areas offer critical spaces to realize Climate Resilient Development by implementing adaptation and mitigation simultaneously with significant potential co-benefits for sustainable development.

For example, nature-based solutions can provide resilience to multiple climate hazards, sequester carbon dioxide, and enhance livelihoods. However, these are constrained if not distributed equitably or if they displace existing livelihoods.

Figure 7: Contributions of urban adaptation to Climate Resilient Development & their feasibility

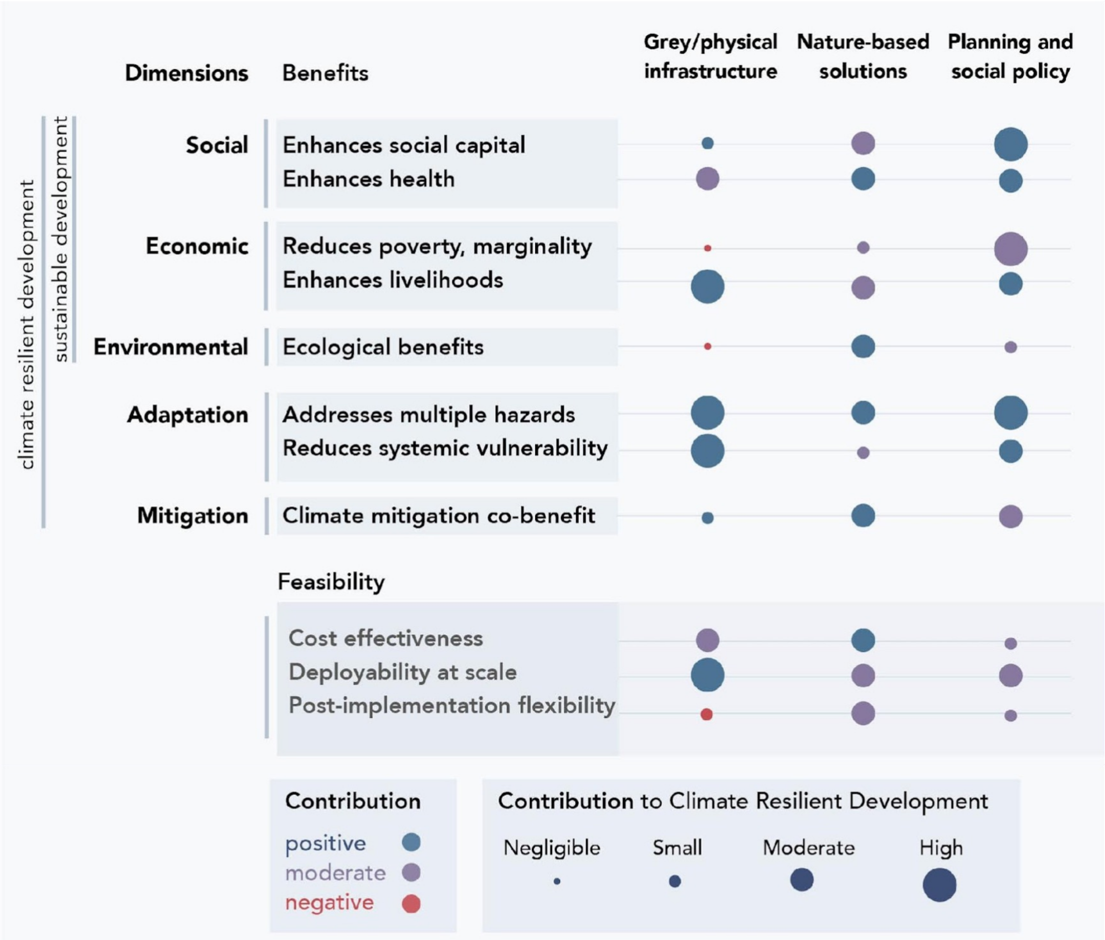

Figure Source: Derived from IPCC AR6 WGII, Chapter 6, Figure TS.9(d)

Enablers for effective Climate Action

Inclusive Governance

Expanded Finance

Institutional Capacities

Technology & Innovation

Lifestyle & Behaviour Change

Image credits: Casey Schackow/Unsplash

How can we implement Transformational Change in the Water sector?