
Masterclass on Climate Resilient Infrastructure Public-Private Partnerships



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Module 1: Refresher on Climate- Resilient Infrastructure



AFRICAN DEVELOPMENT BANK GROUP

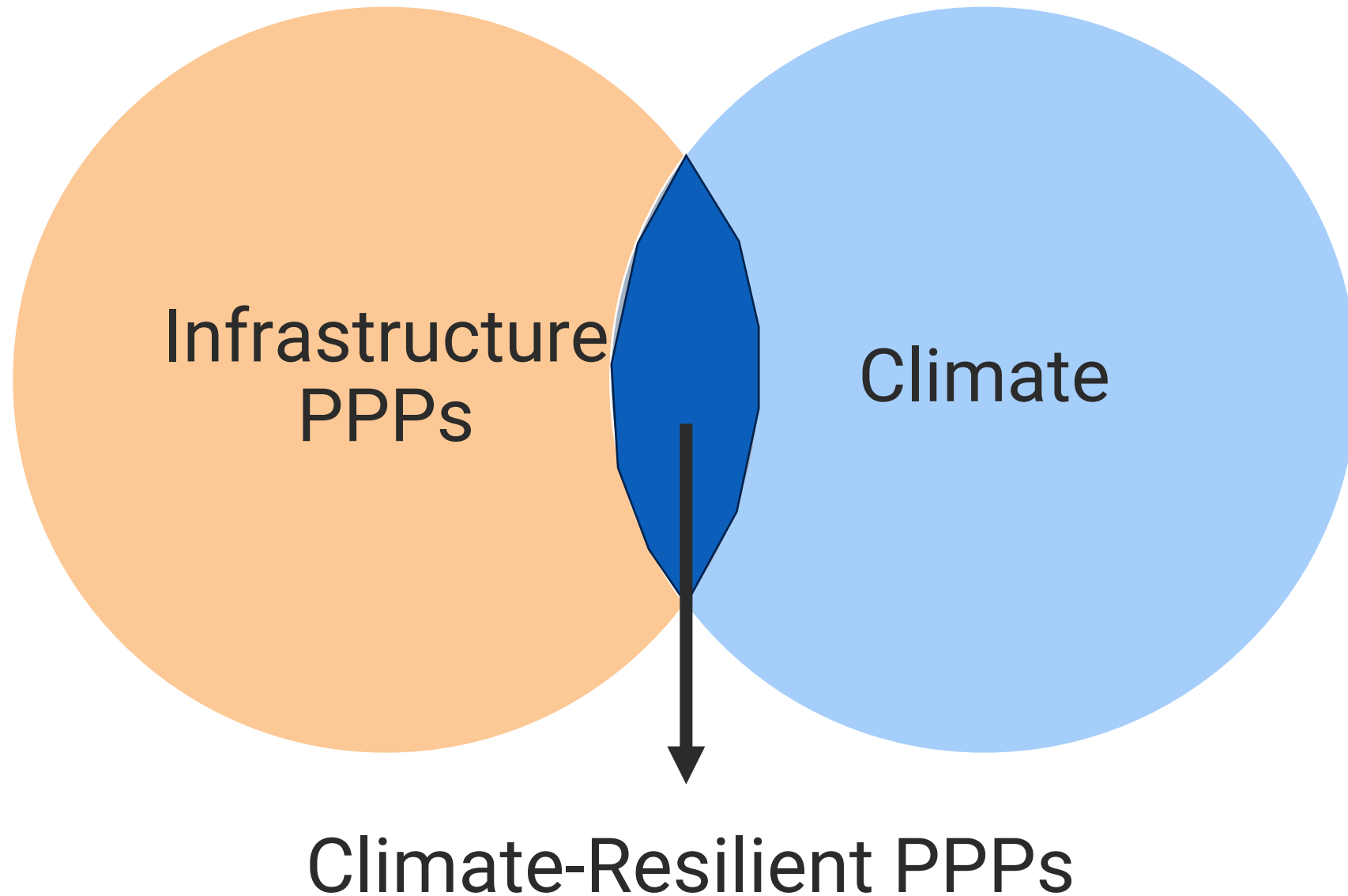


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At the end of this Module, participants will be able to:

- Identify the benefits and guiding principles of PPPs for climate-resilient infrastructure.
- Define climate change and explain its impact on hazardous weather.
- Discuss climate change and climate-related disasters in Ghana.
- Identify the impact of climate change and climate-related hazards on infrastructure and PPPs.
- Recall key concepts related to climate-resilient infrastructure.
- Outline the PPP framework of the Climate-Resilient Infrastructure Handbook.
- Review the phases of the PPP cycle and climate resilience activities.
- Identify international climate adaptation policies and agreements, and national adaptation policies in Ghana.





Outline

Introduction of PPPs

Introduction of Climate

How does Climate Resilience relate to PPPs?

Key Concepts and Definitions

CRIO Handbook



Outline

Introduction of PPPs

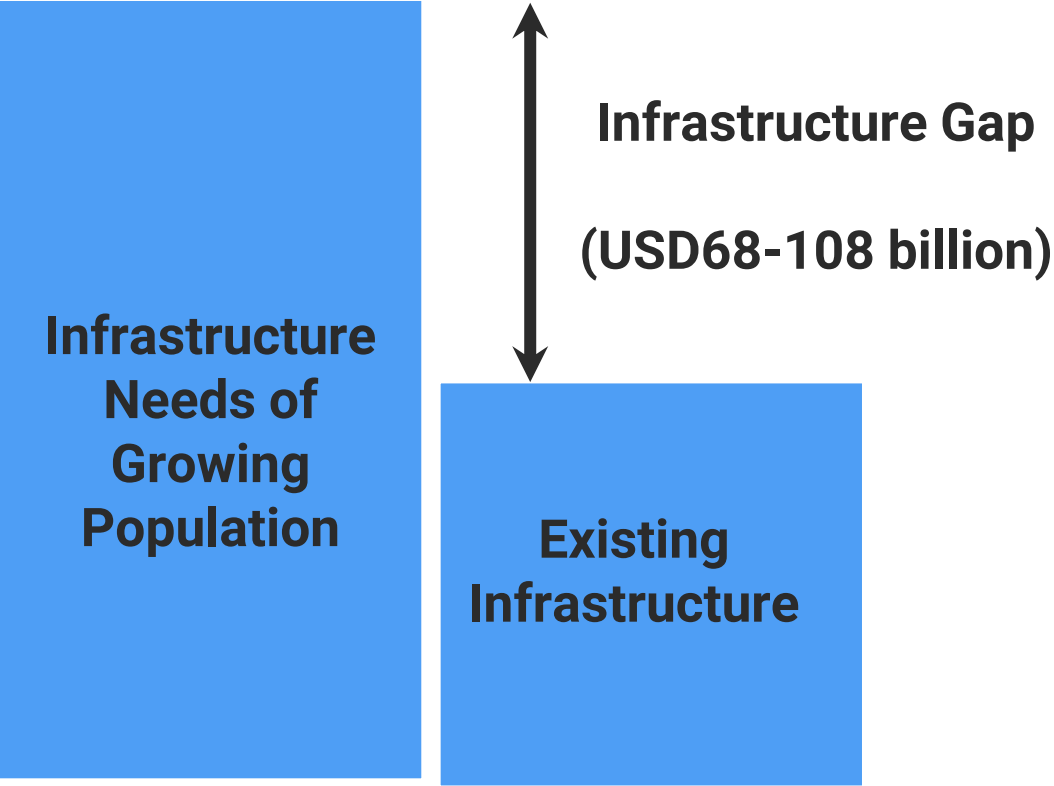
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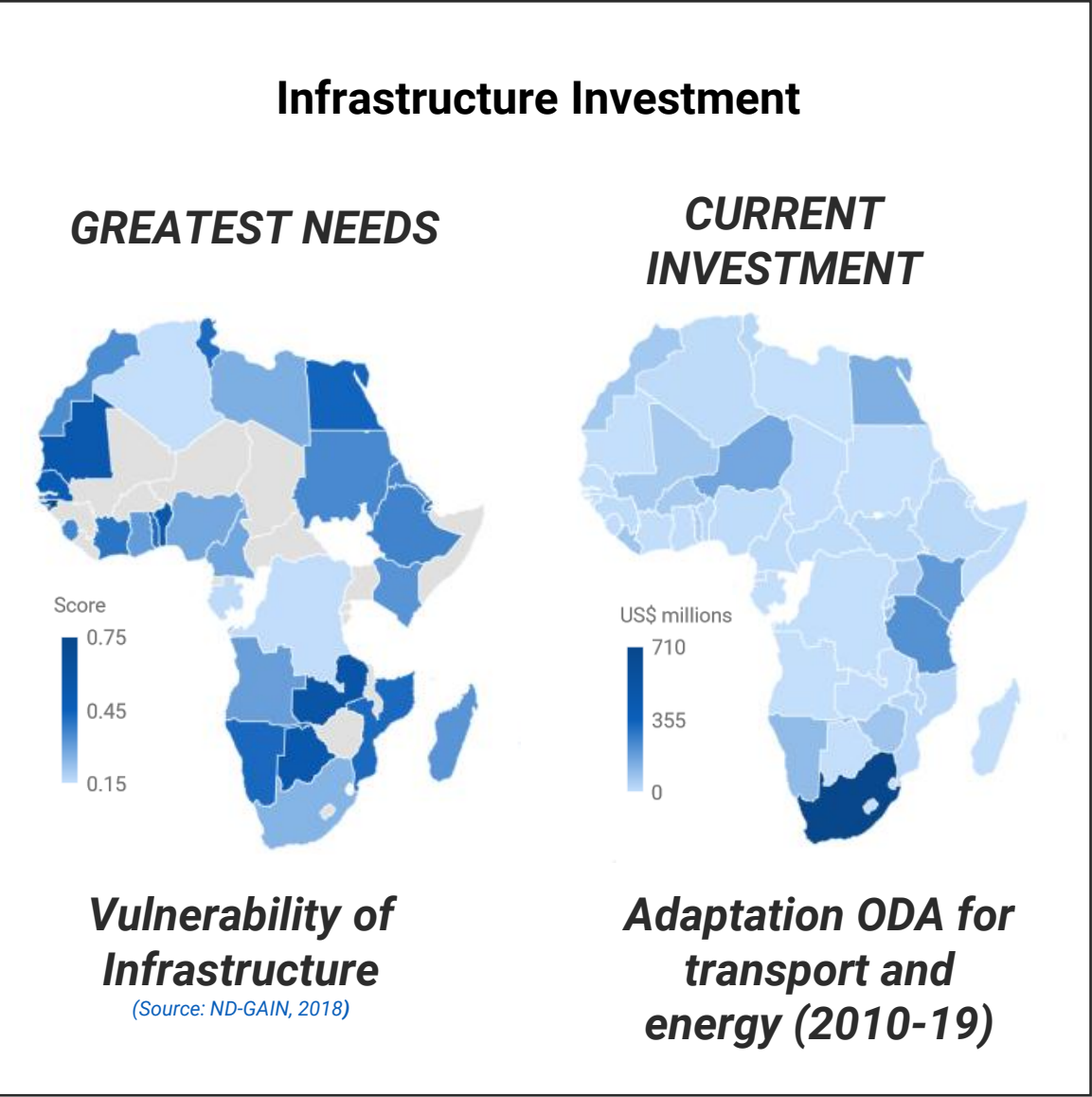
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Introduction of PPPs – the Infrastructure Gap



Source: AfDB-funded Infrastructure Consortium for Africa report from 2020 (<https://www.icafrica.org/en/>)



Source: GCA, 2021: State and Trends in Adaptation Report 2021 (with data from OECD (2021). OECD. Stat database; and University of Notre Dame (2021). ND-GAIN: Notre Dame Adaptation Initiative – Country Index)

Public Private Partnerships provide an opportunity to crowd private finance into infrastructure...

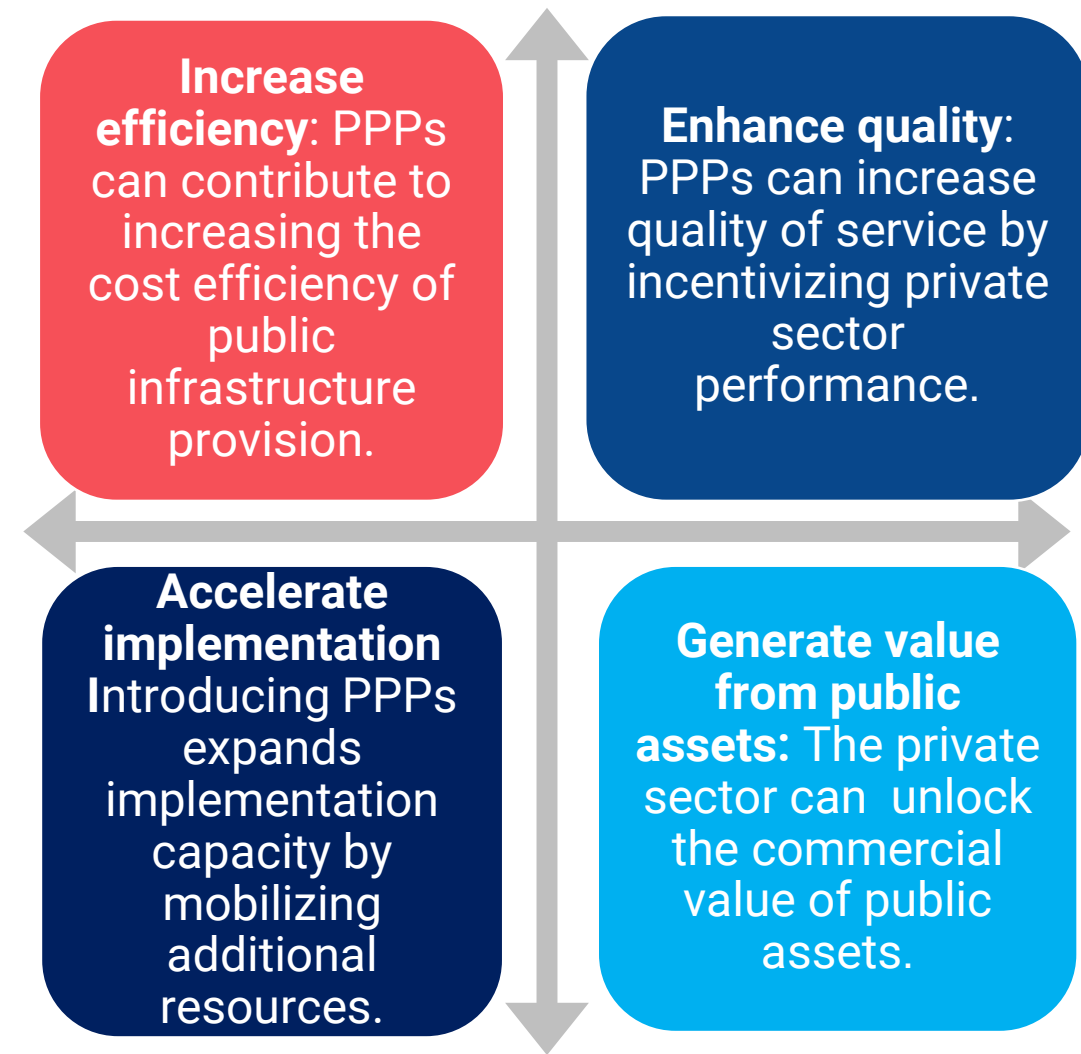
In the context of the USD 68 to 108 billion infrastructure investment gap in Africa....

- PPPs can provide **Value-for-Money** by bringing in private-sector expertise and innovation.
- PPPs can also bring in much-needed expertise to enable better whole-life asset management, including optimising design and construction and ensuring better **maintenance of assets**.
- PPPs may also be more able to deliver projects **on-time and on-budget**.



1. Value for Money
2. Affordability
3. Commercial Viability and Bankability
4. Manageability
5. Acceptability

Risk allocation is a key driver in all of this.



Different sources of value for money



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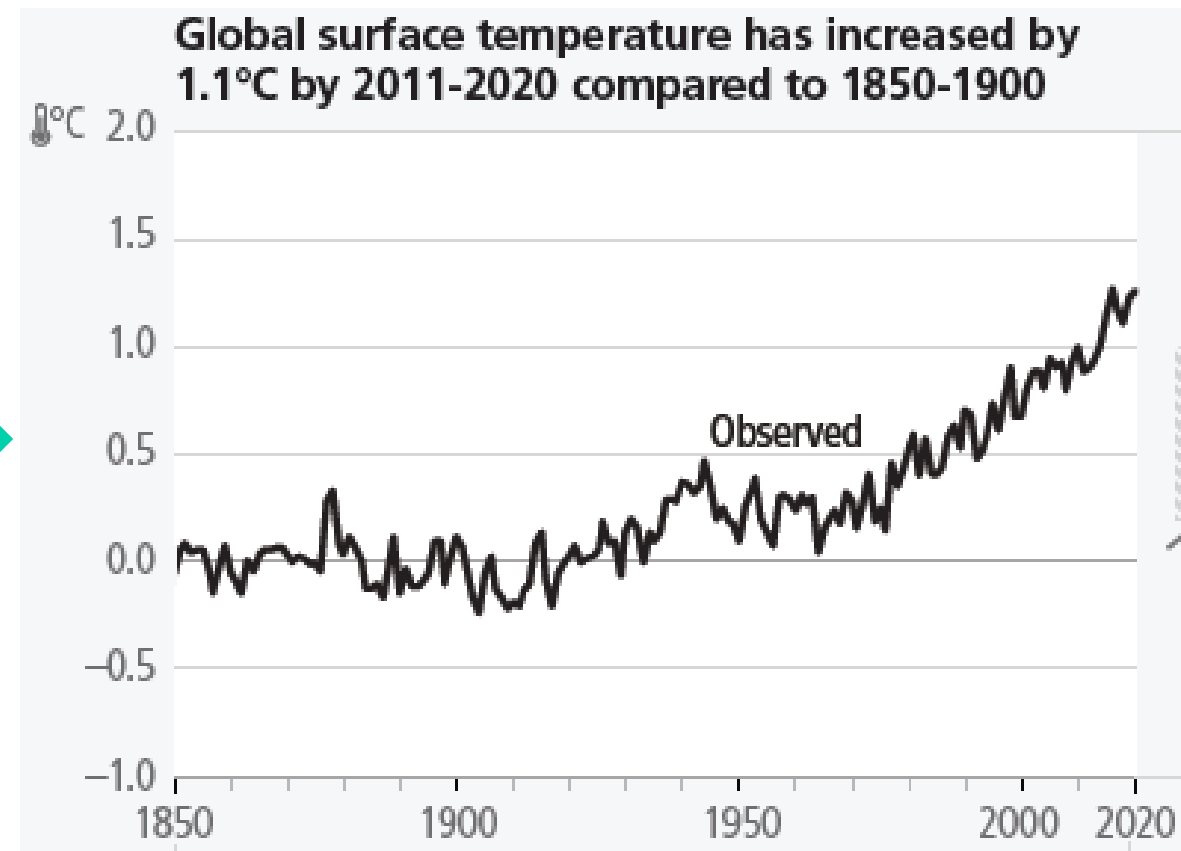
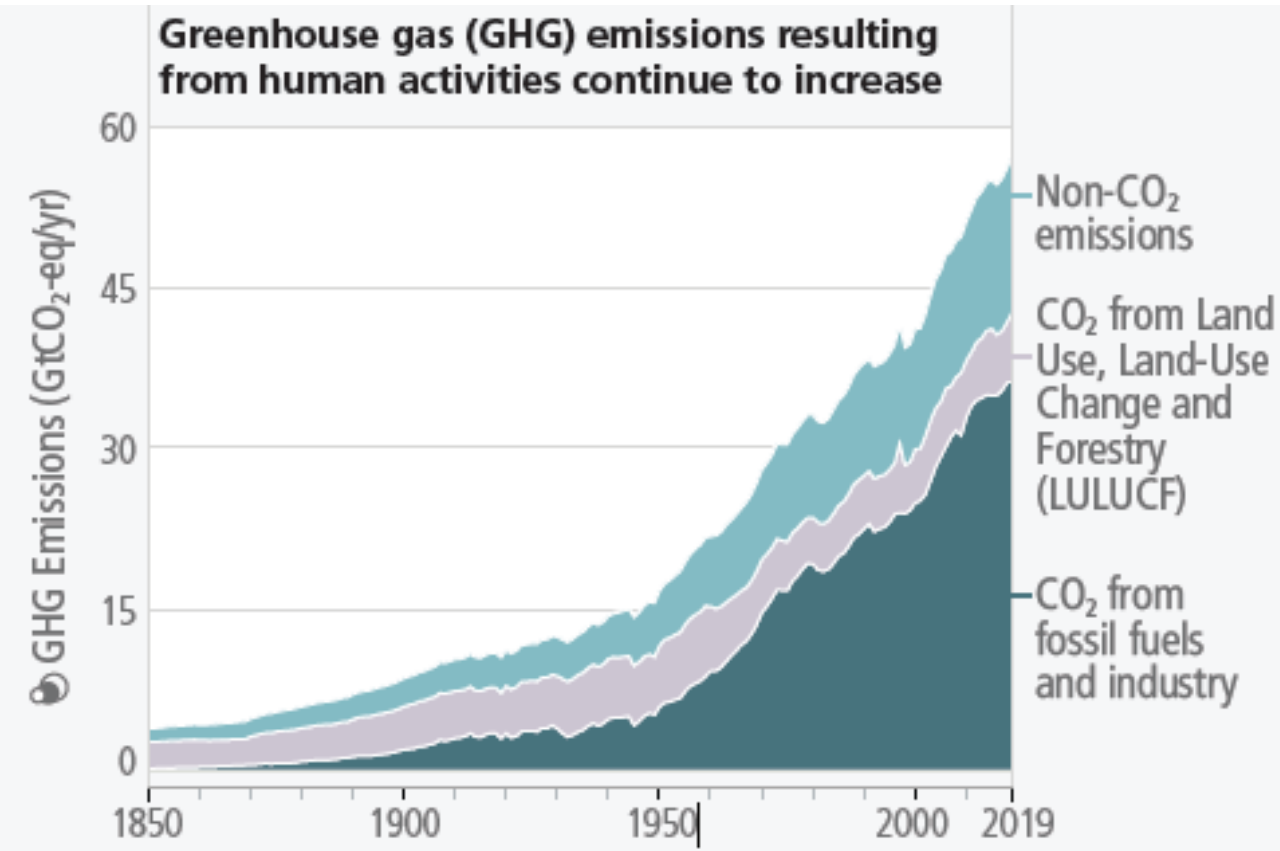
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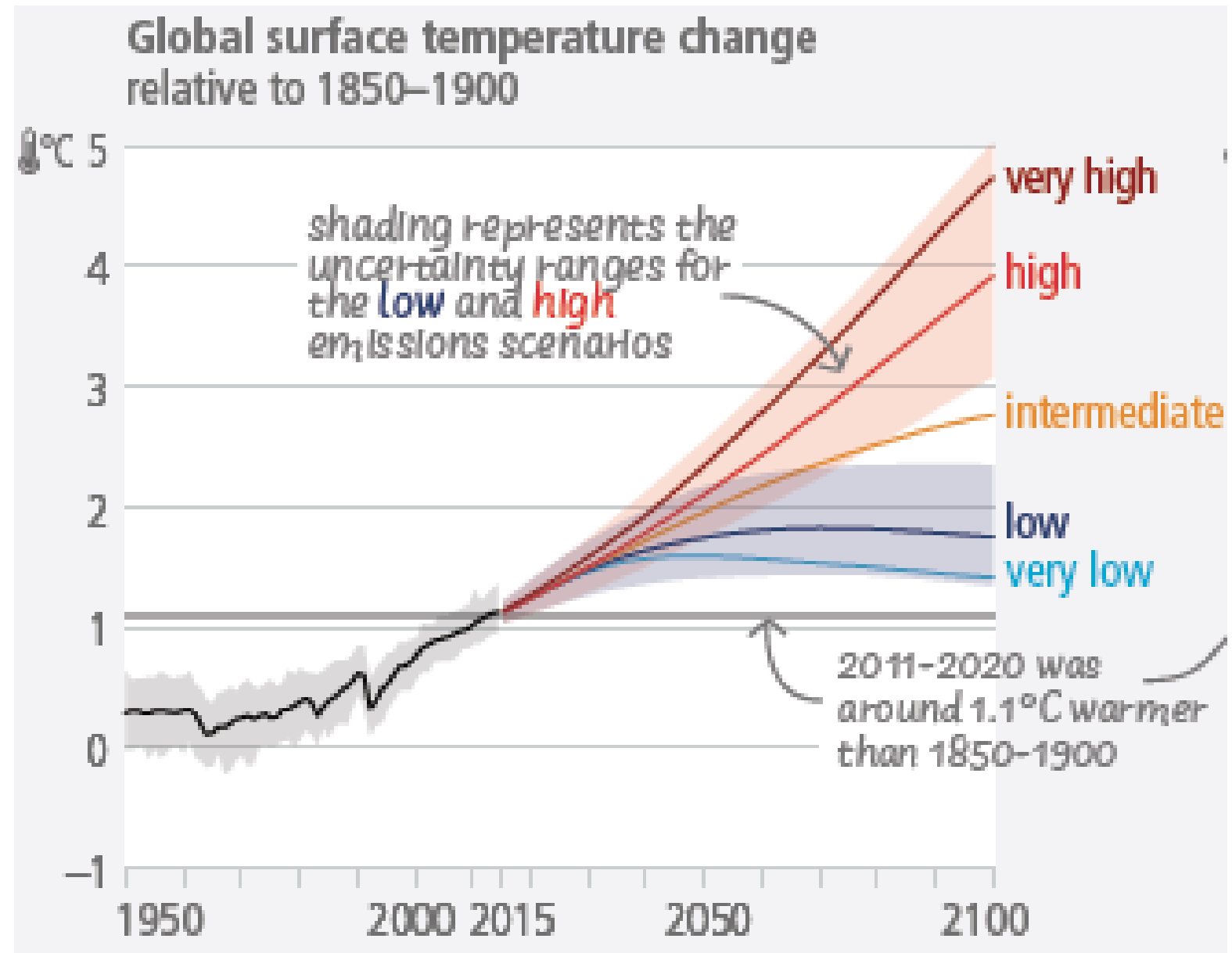
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Climate Change is real

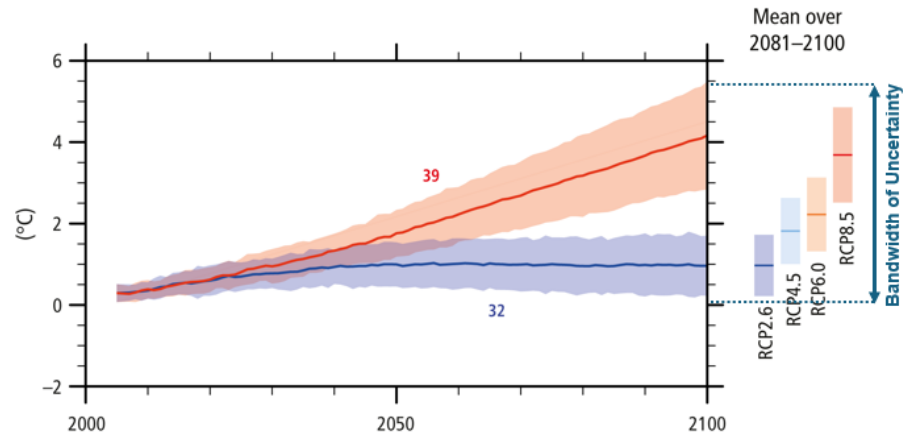


Forecasts of future climate change

Forecast global surface temperature change by 2100 ?



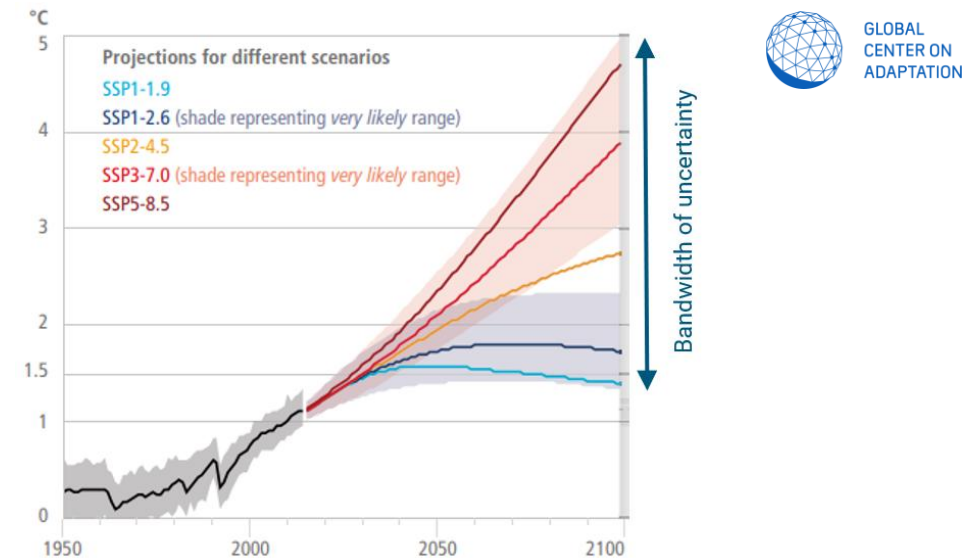
Climate change scenarios



Representative Concentration Pathways (RCPs)

RCPs scenarios focus on different levels of **GHG concentrations** in the atmosphere, air pollution and land use change.

They range from low-emission scenarios (RCP2.6) to high-emission scenarios (RCP8.5).



Shared Socioeconomic Pathways (SSPs)

SSPs scenarios consider various **socioeconomic factors** like population growth (and literacy rate), urban growth, economic development (measured in GDP), and technological advancements.

They illustrate whether **(global) climate policies are likely to be achieved or not** and, for example, how warmer will the global temperatures be.

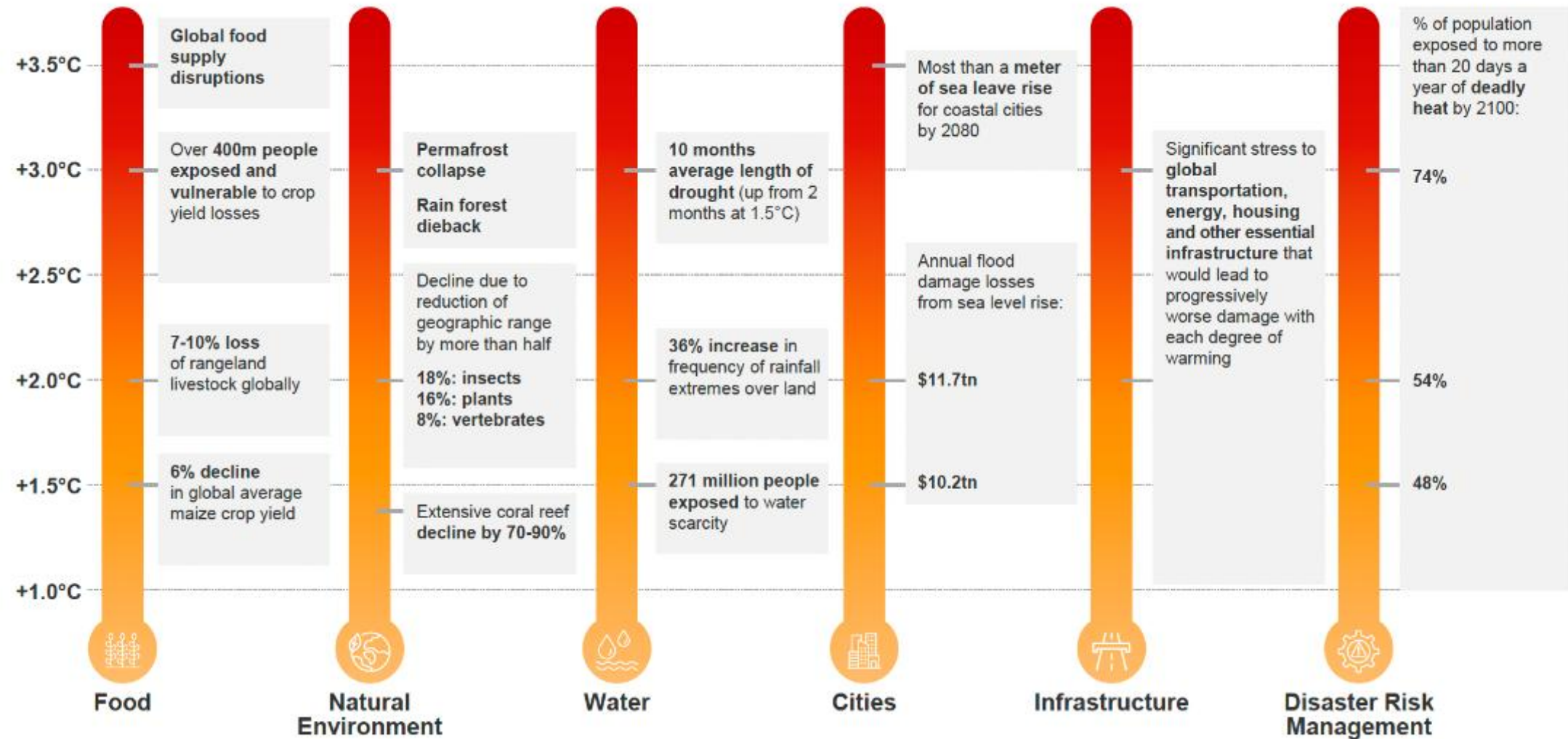
They help explore how different societal choices impact climate outcomes and range from SSP scenarios, from low-emission (SSP1-1.9) to high-emission (SSP5-8.5).

Climate change scenarios

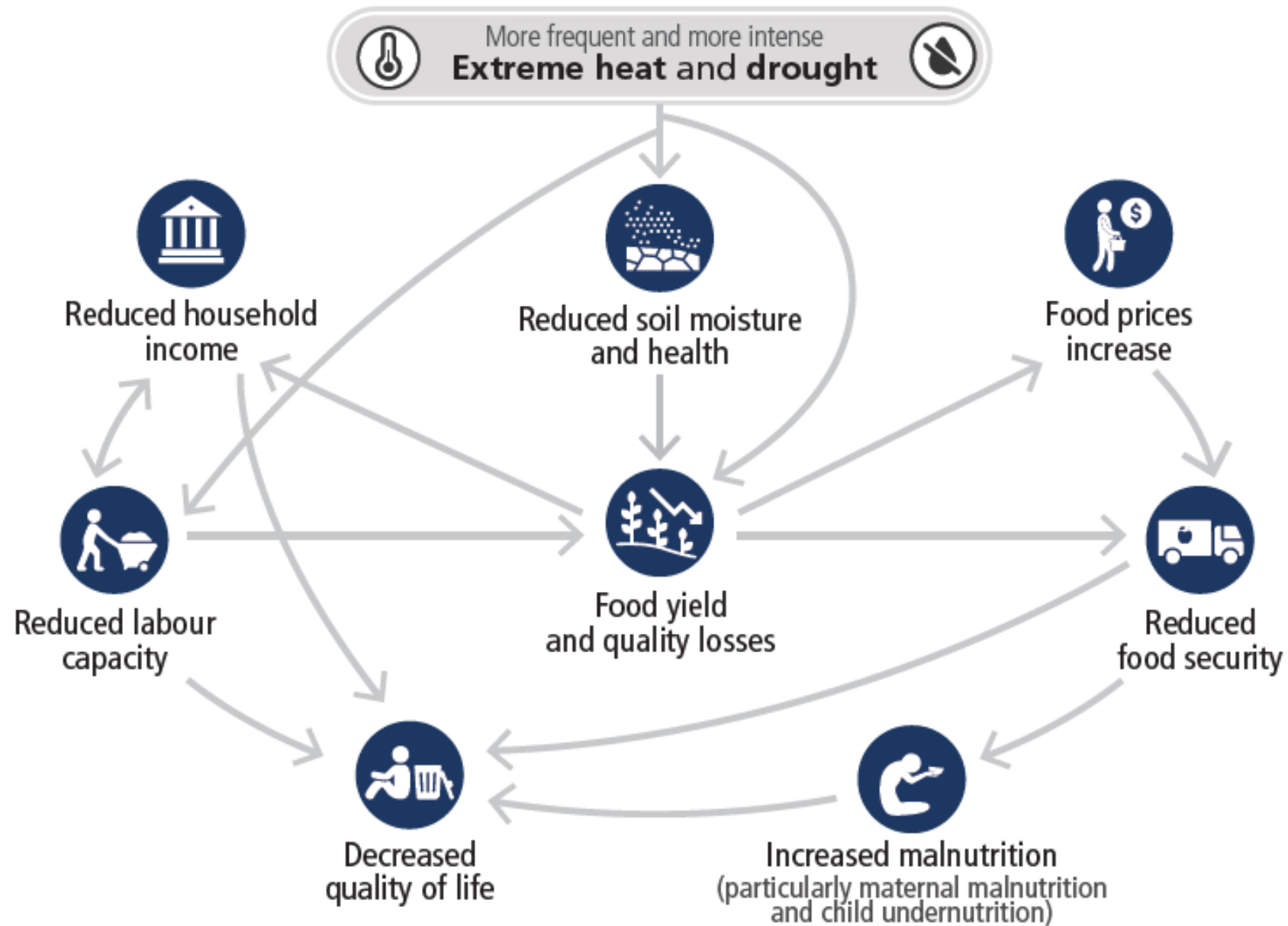
Indicator	Representative Concentration Pathways			Shared Socioeconomic Pathways		
Global mean surface temperature change (°C)	Scenario	Mean	Likely Range	Scenario	Mean	Likely Range
	RCP2.6	1.0°C	0.3°C -1.7°C	SSP1-1.9	1.4°C	1.0°C -1.8°C
	RCP4.5	1.8°C	1.1°C -2.6°C	SSP1-2.6	1.8°C	1.3°C -1.4°C
	RCP6.0	2.2°C	1.4°C -3.1°C	SSP2-4.5	2.7°C	2.1°C -3.5°C
	RCP8.5	3.7°C	2.6°C -4.8°C	SSP3-7.0	3.6°C	2.8°C -4.6°C
				SSP5-8.5	4.4°C	3.3°C -5.7°C
Global mean sea level rise (m)	Scenario	Mean	Likely Range	Scenario	Mean	Likely Range
	RCP2.6	0.40m	0.26m-0.55m	SSP1-1.9	0.38m	0.28m-0.55m
	RCP4.5	0.47m	0.32m-0.63m	SSP1-2.6	0.44m	0.32m-0.62m
	RCP6.0	0.48m	0.33m-0.63m	SSP2-4.5	0.56m	0.44m-0.76m
	RCP8.5	0.63m	0.45m-0.82m	SSP3-7.0	0.68m	0.55m-0.90m
				SSP5-8.5	0.77m	0.63m-1.01m

Source: IPCC 5th Assessment Report (2014) [[Link](#)] and IPCC 6th Assessment Report (2021) [[Link](#)]

There is no safe future climate scenario



Cascading effects of extreme climate

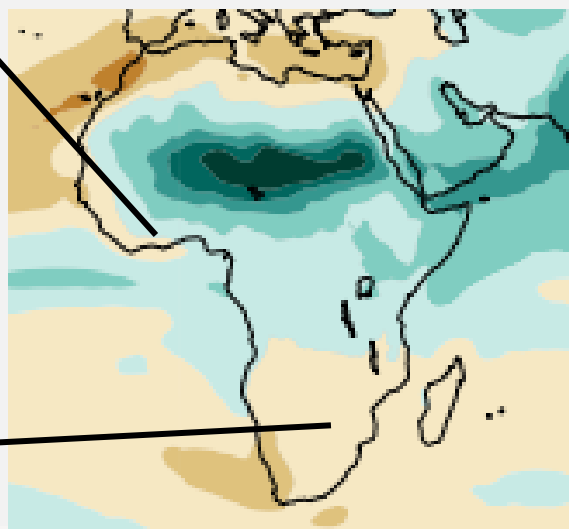


Effects of climate on infrastructure in Africa

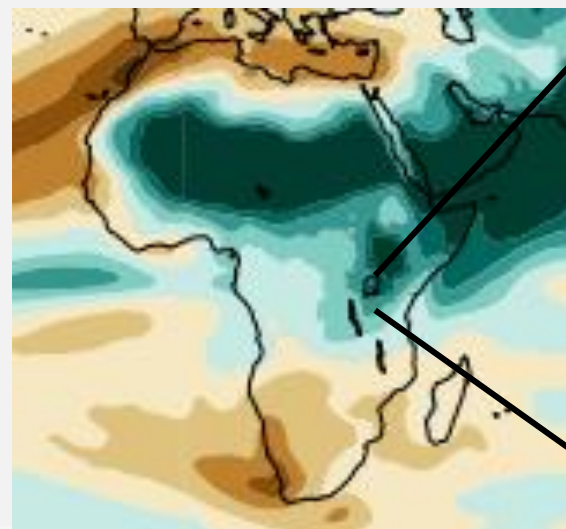
Damages to **Ghana's** road network can reach **US\$ 4 billion** for a high-flood scenario and **14 million people** may lose access to healthcare

Annual mean precipitation change

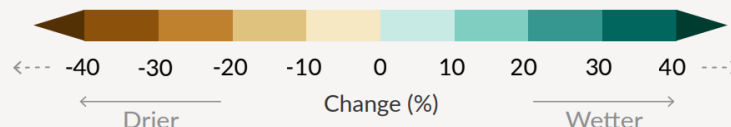
Simulated change at 2 °C global warming



Simulated change at 4 °C global warming



Relatively small absolute changes may appear as large % changes in regions with dry baseline conditions



4% of roads in Uganda's capital city of Kampala are exposed to floods in a 50-year flood event

Drought in the Kariba Dam in **Zimbabwe** caused **US\$ 200 million** in losses through lost hydropower production

In **Tanzania**, disruptions to power supply and transport disruptions lead to a **decrease of 0.7% of GDP** each year



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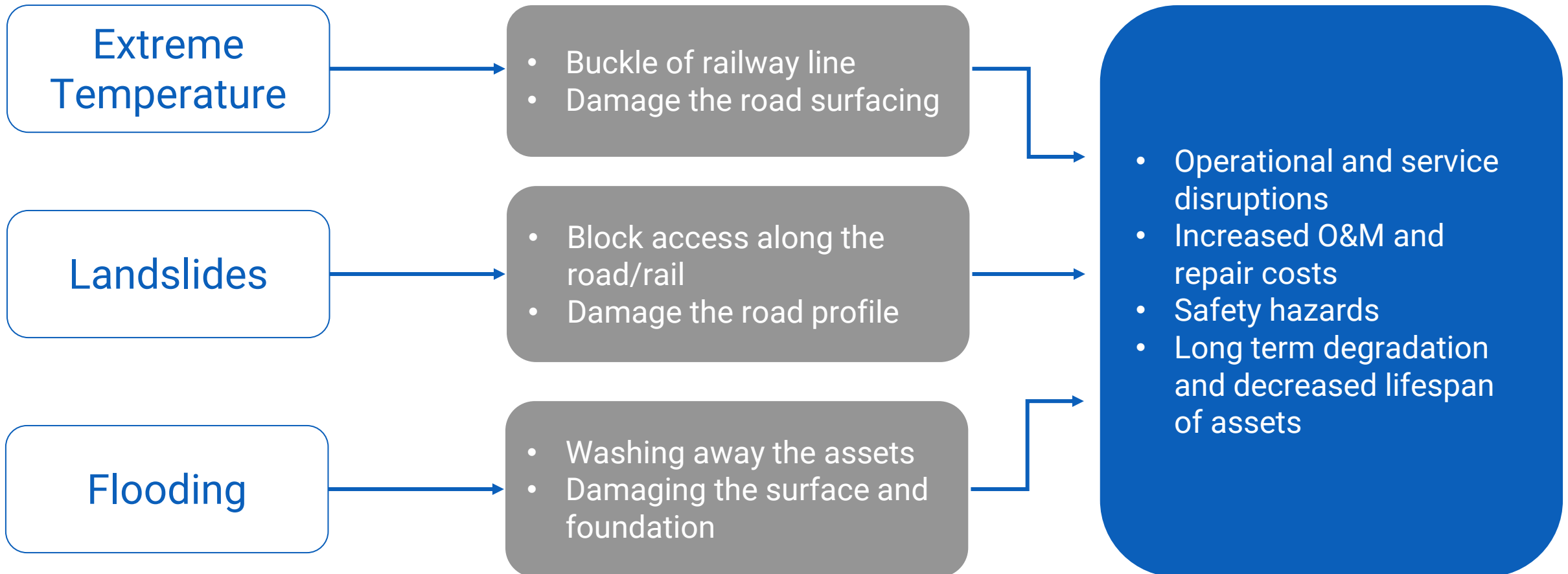
Key Concepts and Definitions

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Climate Hazard

Impacts on Assets

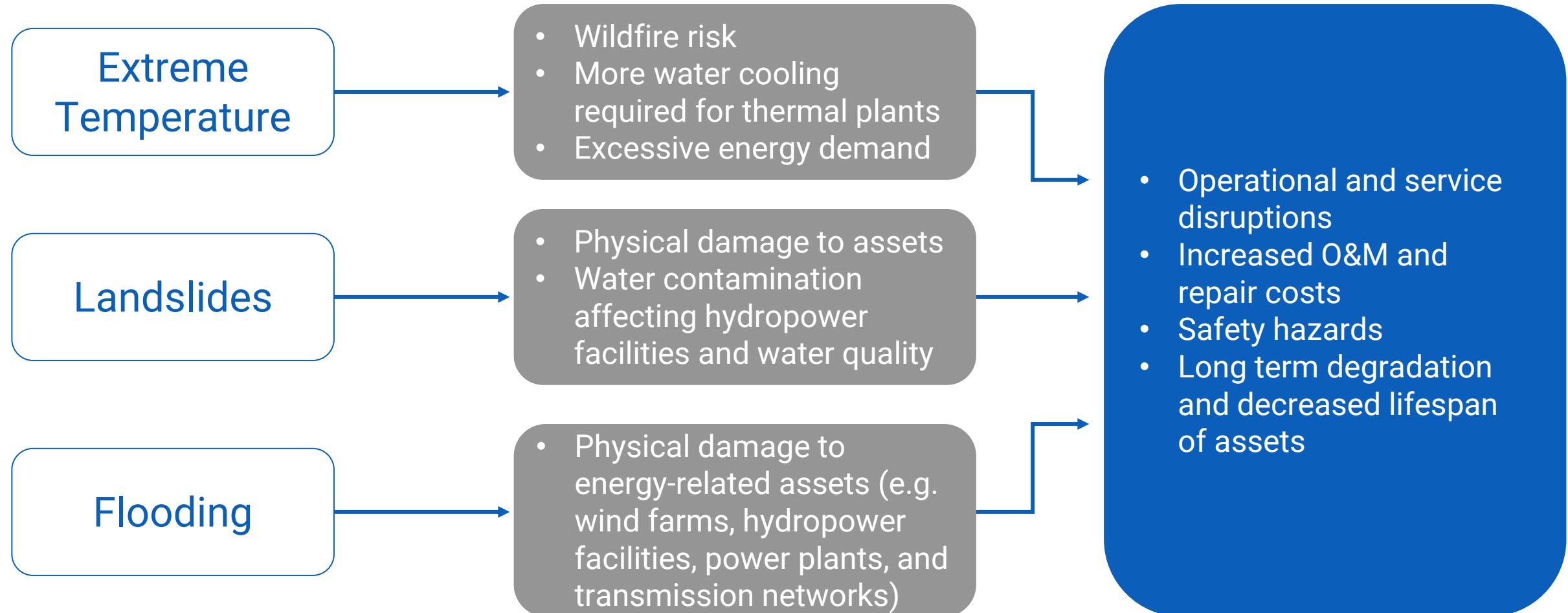
Effects on PPP



Climate Hazard

Impacts on Assets

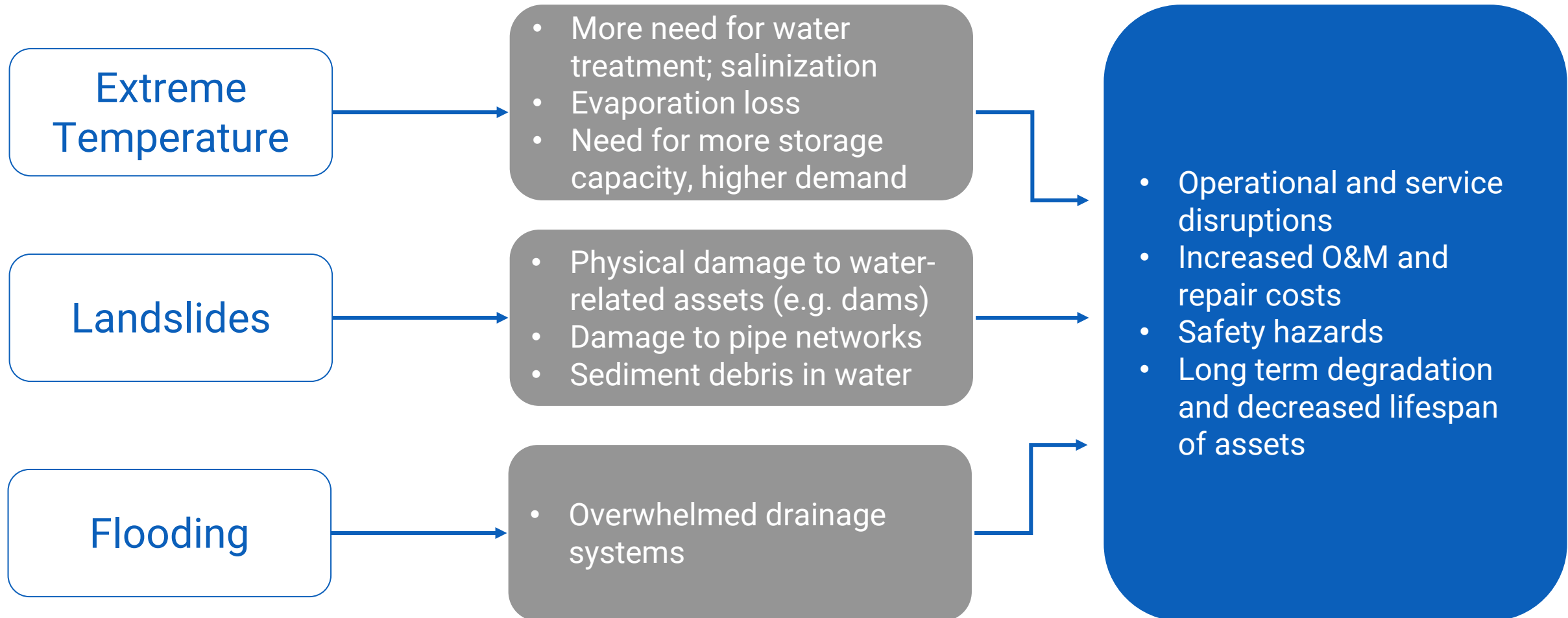
Effects on PPP



Climate Hazard

Impacts on Assets

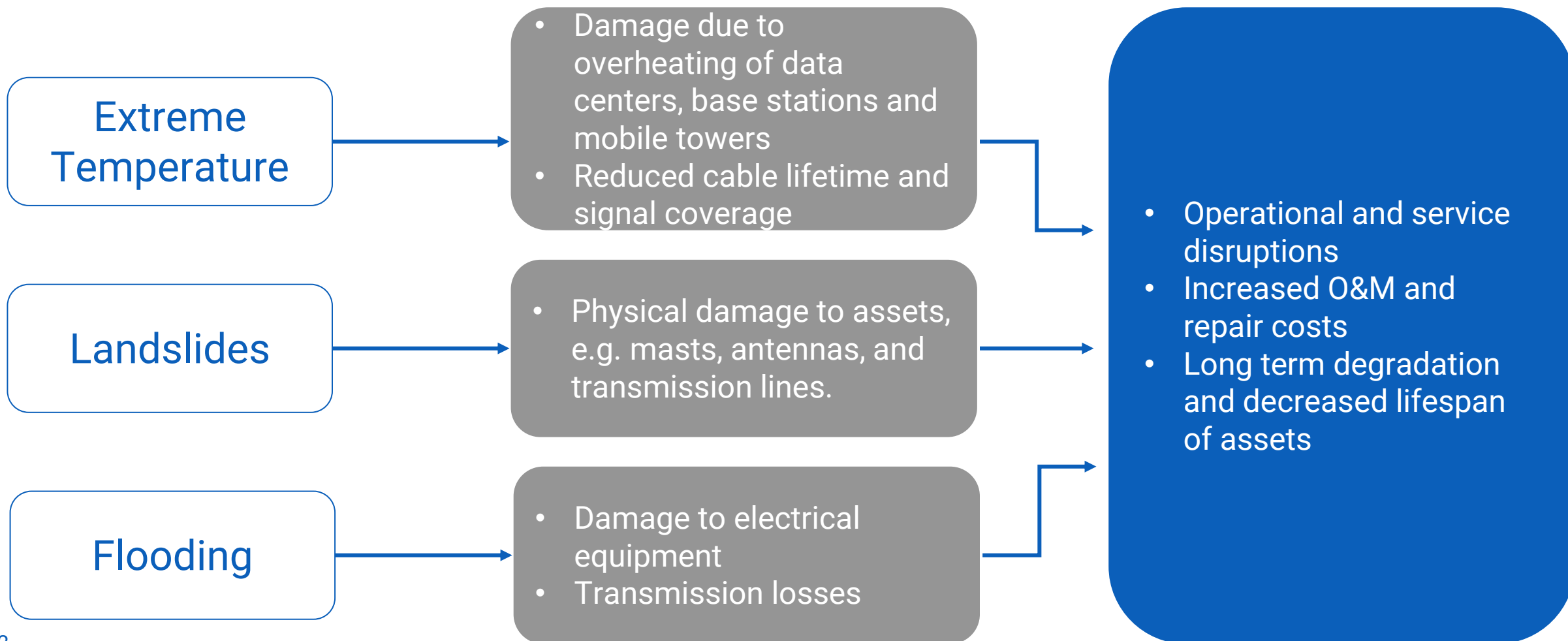
Effects on PPP



Climate Hazard

Impacts on Assets

Effects on PPP



Why address Climate Risks?

- Avoidance of **repair costs** due to damage from extreme weather events or gradual shifts in climate.
 - Lack of repair can lead to **reduced lifespan** of the asset
- **Reduced service interruptions** - when services are uninterrupted by climate risks:
 - Maximised realisation of benefits of infrastructure system to public sector; and
 - Maximised returns to private sector
- **Co-benefits** that resilience solutions bring to the project and the broader social and natural environmental.
- 'Climate proofing' is increasingly required as part of **innovative financing and funding mechanisms**, tying financing to investments that meet specific criteria.

Broadly, the impacts of climate hazards impose challenges to:

- Operability of infrastructure assets
- Economic stability
- Public health and safety
- Quality of life



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How is weather different from climate?

Weather and climate describe the same thing—the state of the atmosphere—but at different time scales.



Weather is what you experience when you step outside on any given day. In other words, it is the state of the atmosphere at a particular location over the short-term.



Climate is the average of the weather patterns in a location over a longer period of time, usually 30 years or more.

Climate change mitigation

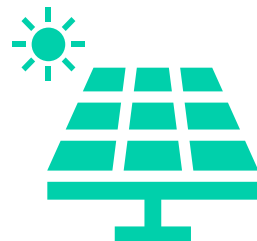
A human intervention to reduce emissions (sources) or enhance the sinks of greenhouse gases (GHGs)

Climate change adaptation

The process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities

Example of a climate change mitigation action:

Generate energy from solar panels instead of from diesel generators



Example of a climate change adaptation action:

Installation of additional culverts under a road to deal with a forecast increase in rainfall intensity in future.



Climate change adaptation

The process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities

Climate Resilience

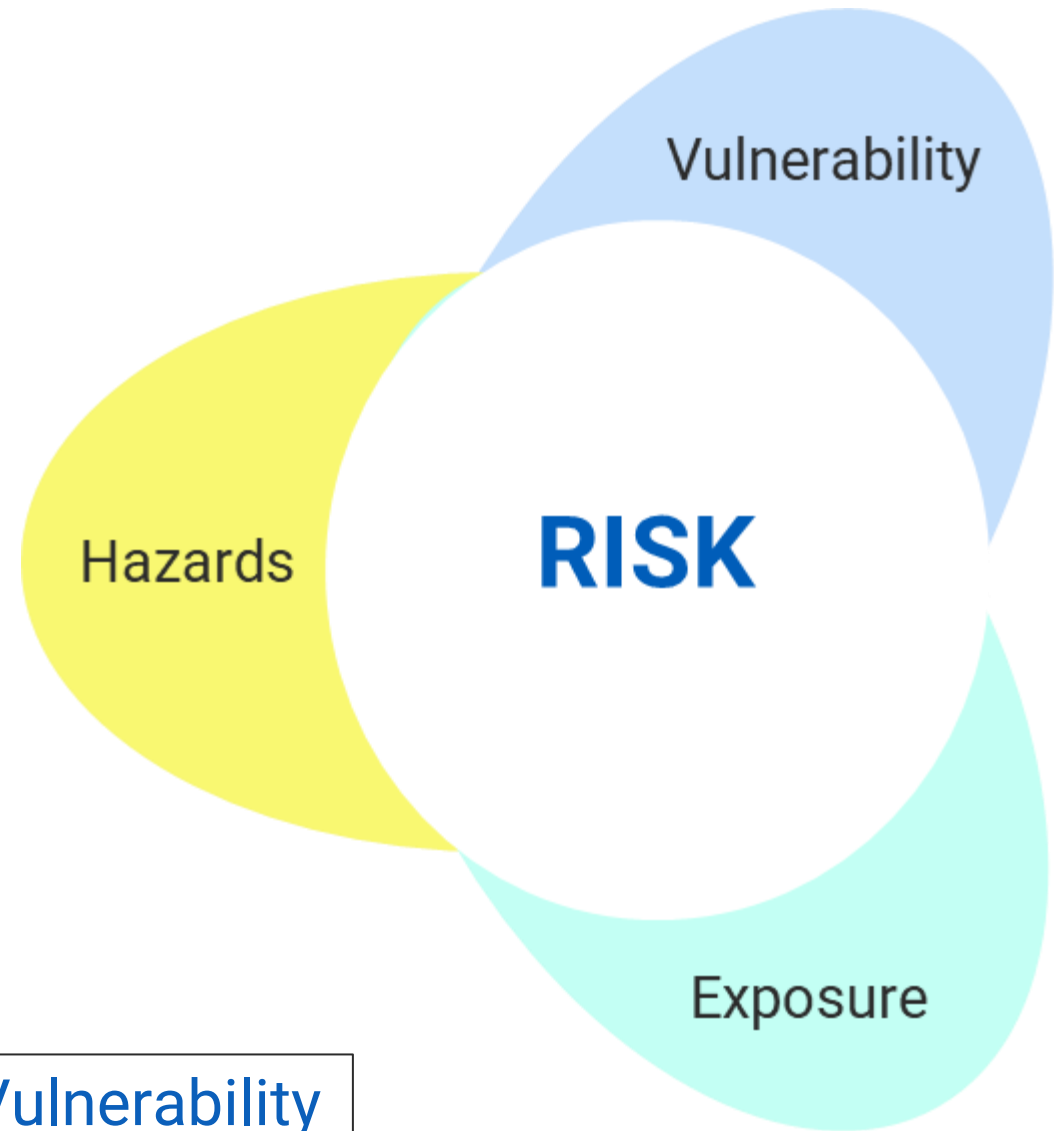
The capacity of social, economic and environmental systems to cope with a hazardous climatic event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure

Resilience

The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure

- **Risk** is the potential for adverse consequences to *lives, livelihoods, health and well-being, ecosystems and species, economic, social and cultural assets, services (including ecosystem services), and infrastructure*.
- ‘maybe something bad will happen’
- Risk results from interaction of the climate-related **hazard** (incl likelihood of its occurrence), **vulnerability** (of the affected system) and its **exposure** over time (to the hazard).

$$\text{Risk} = \text{Hazard} \times \text{Exposure} \times \text{Vulnerability}$$



Hazards

- Natural (or human-induced) processes, phenomenon, or events that cause damage or disruption
- Hazard is a function of
 - 1) Frequency of occurrence; and
 - 2) Intensity of the event

Hazards

- | | |
|---------------------|--------------|
| ○ Floods | ○ Wildfires |
| ○ Tropical cyclones | ○ Lightning |
| ○ Storms | ○ Landslides |
| ○ Sea level rise | |
| ○ Drought | |
| ○ Heat | |
| ○ Earthquake | |
| ○ Volcano | |
| ○ Tsunami | |

Characterisation

Related to extreme weather events
- *Acute Climate-related Hazards*

Related to gradual shifts in climate
- *Chronic Climate-related Hazards*

Not directly caused by climate factors
- *Non-climate-related Hazards*

Lead to Climate Risk?



Exposure

- The presence of
 - people;
 - livelihoods;
 - species or ecosystems;
 - environmental functions, services and resources;
 - infrastructure; or
 - economic, social, or cultural assetsin places and settings that could be adversely affected.

‘What is exposed to the hazard?’

e.g. homes located in a flood zone



Vulnerability

- The propensity or predisposition to be adversely affected.
- Vulnerability encompasses a variety of concepts and elements including **sensitivity** and **adaptive capacity**

‘How things are affected by the hazard’

Sensitivity

- Degree to which a **system** is (harmfully) impacted by exposure

Examples:

- livelihoods based on agriculture are sensitive to climate-related drought
- farmers who trap run-off water for irrigation have reduced their sensitivity to drought

Adaptive Capacity

- The ability of **systems, institutions, humans and other organisms** to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.

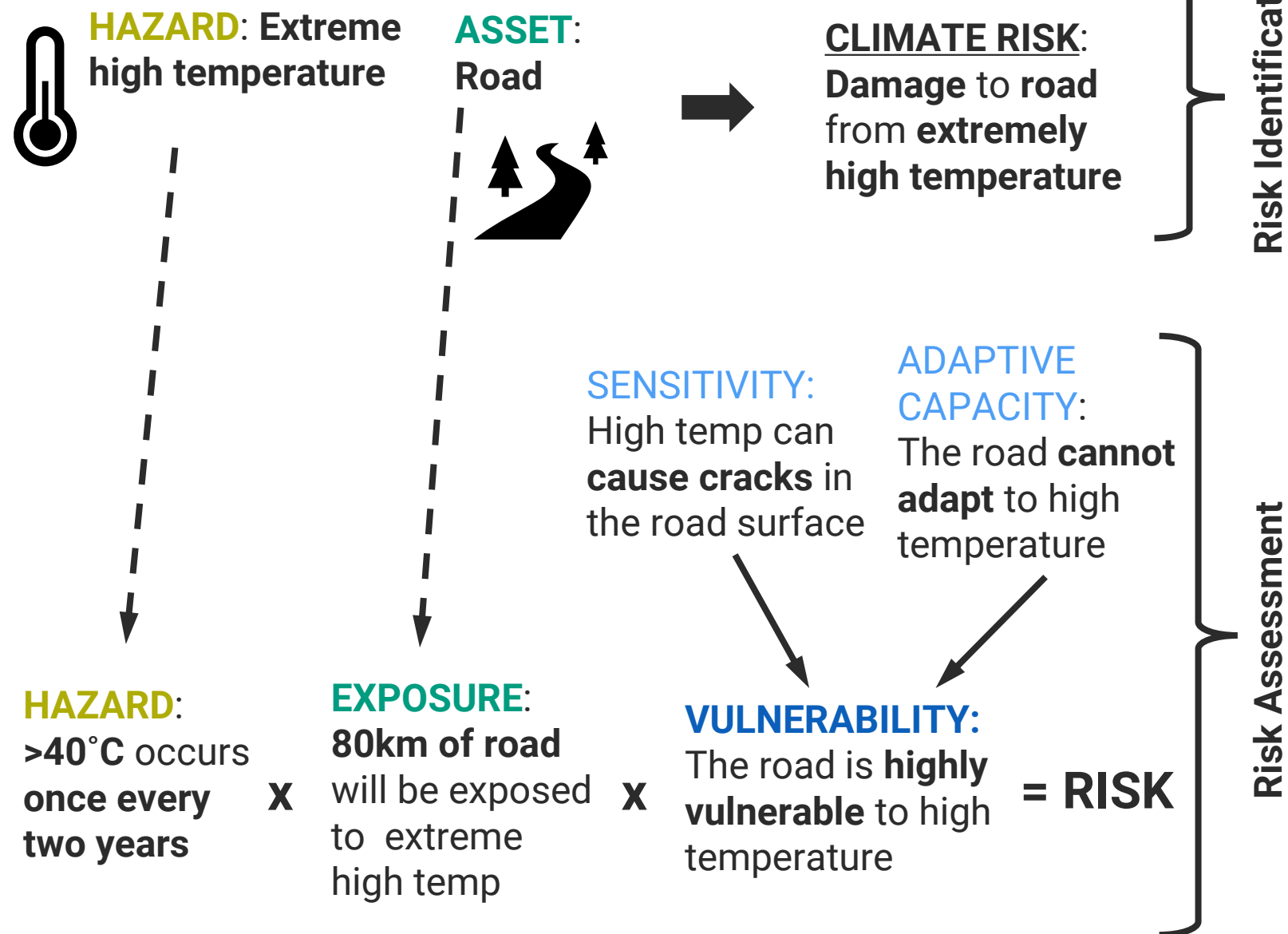
Examples:

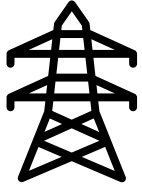
- Farmers using drought resistant crops have increased their adaptive capacity to drought

Illustration of Climate Risk Terms through Example

- **Hazard**: Natural or human-induced events that cause damage or disruption.
- **Asset**: A man-made or natural object which has value.
- **Climate Risk**: The potential for adverse consequences of a climate-related hazard
- **Exposure**: The presence of the asset in places that could be adversely affected
- **Sensitivity**: the degree to which a system is impacted by exposure.
- **Adaptive capacity**: The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.
- **Vulnerability**: The propensity or predisposition to be adversely affected. Vulnerability is a function of:
 - Sensitivity
 - Adaptive capacity

Example: Extreme Temp & Road

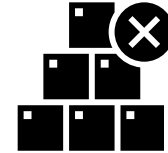




Resilience of infrastructure –

Infrastructure that is planned, designed, built, operated, and maintained in a way that prepares for and adapts to changing climate conditions. It can also withstand and rapidly recover from disruptions caused by these climate conditions.

Example: developing drainage systems to ensure that a road network does not experience washouts



Resilience through infrastructure –

Infrastructure put in place primarily to increase the resilience of a targeted community or asset by reducing exposure and vulnerability to a climate hazard or increasing the adaptive capacity of the community or asset.

Example: design a coastal road an extra metre higher, on a levee or dike, to provide coastal flooding protection to inland areas

Different kinds of infrastructure...



Grey infrastructure – Grey infrastructure are built up, engineered and physical structures.

Often made of concrete or other long-lasting materials.



Green infrastructure – Green infrastructure involves healthy and well-functioning biophysical systems, primarily related to green spaces, that support biodiversity, natural ecological processes.

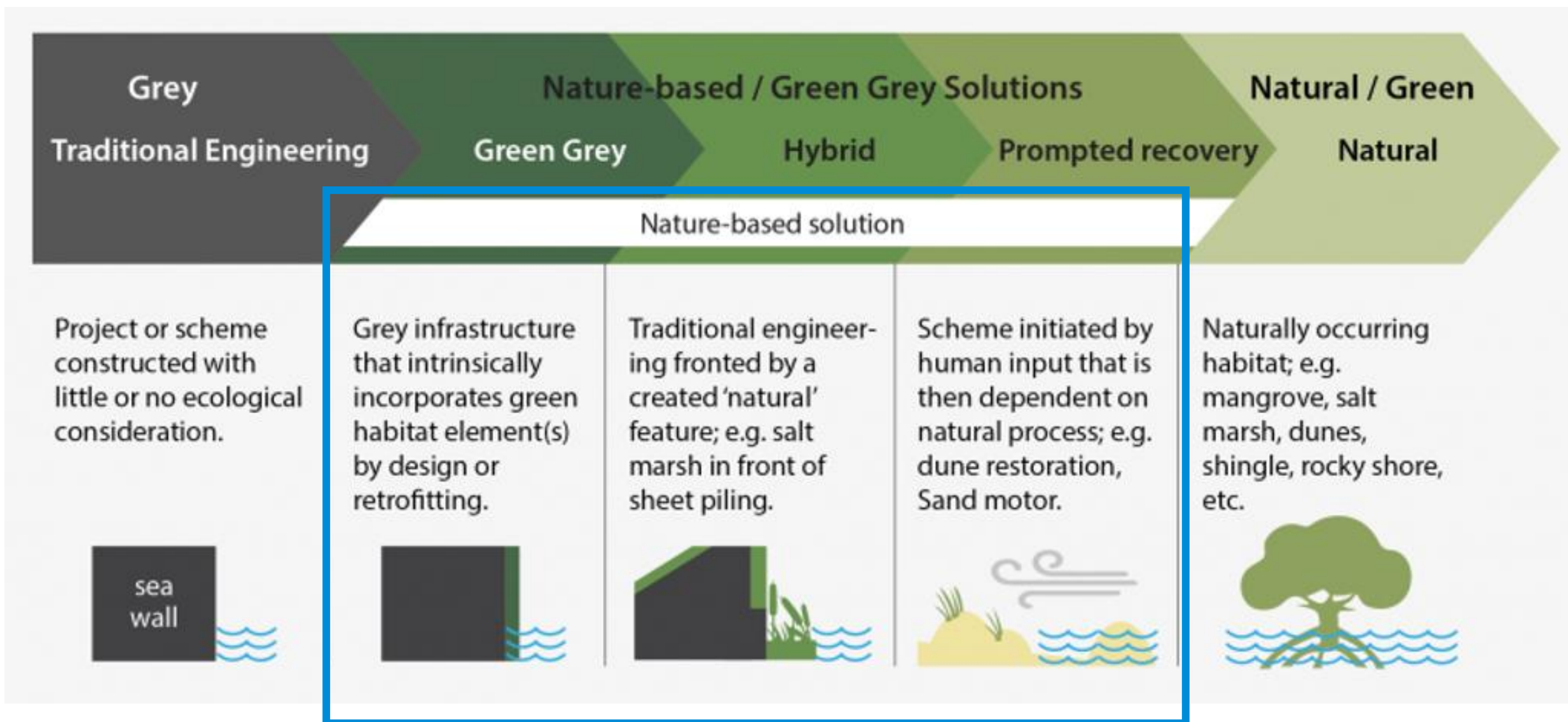


Blue infrastructure – Blue infrastructure can be also characterized by well-functioning biophysical systems, but primarily related to water.

This includes water bodies, including ponds, wetlands, rivers, lakes, and streams, as well as estuaries, seas, and oceans.

They are represented, by healthy oyster reefs, coastal salt marshes, mangroves, coral reefs, sea grasses, sand beaches and dunes in the coast environment and mainly by forests, parks, street trees, and grasslands inland.

A different kind of approach... Nature-based Solutions (NbS)



***Are any of these concepts new to you?
If so, which ones?***



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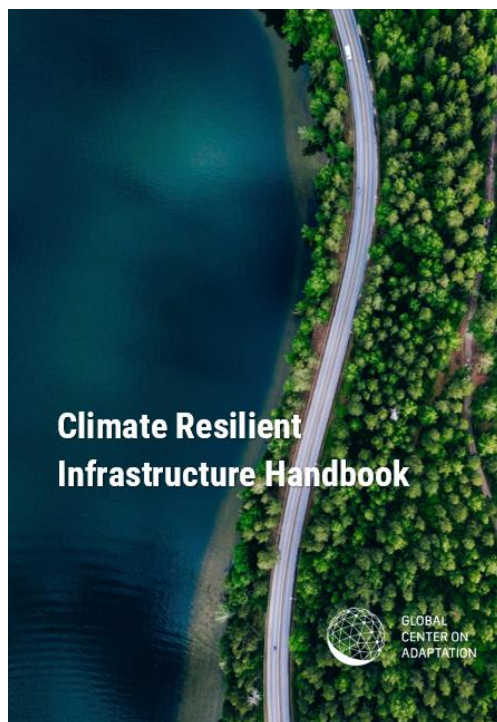
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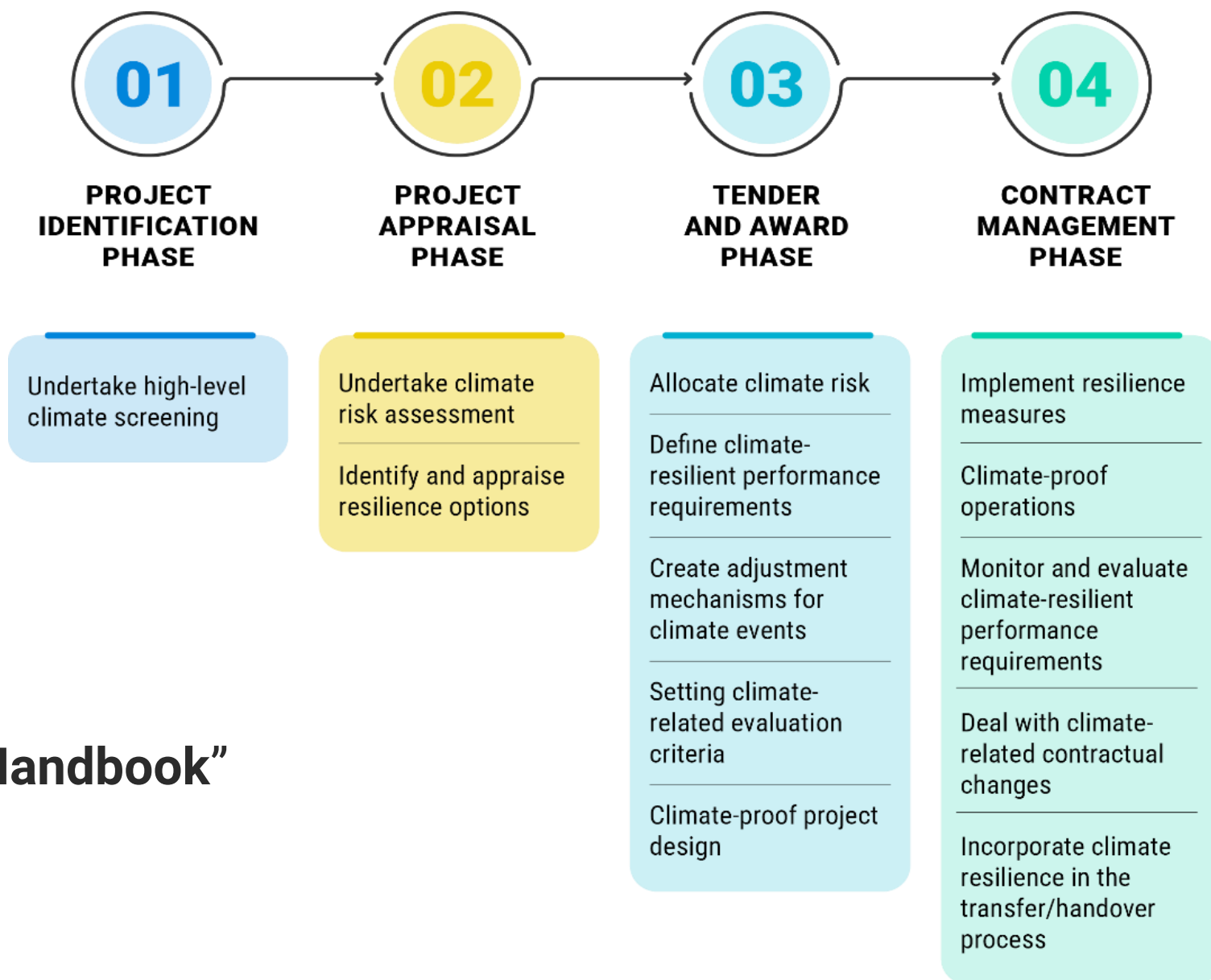
CRIO Handbook

Considering climate resilience at every phase: a framework

- **GCA Climate-Resilient Infrastructure Officer Handbook:**
 - Knowledge Module on Public-Private Partnerships for Climate-Resilient Infrastructure



“the CRIO Handbook”



Recap: Module 1 - Refresher on Climate-Resilient Infrastructure

1

There is a need to address the **infrastructure gap**

2

Global **climate change** is really happening

3

In Africa, **climate hazards** are **impacting infrastructure**

4

There are **economic and social benefits** in addressing climate risks

5

Risk = Hazard x
Exposure x
Vulnerability

6

CRIO Handbook is available as a resource

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