→ EARTH OBSERVATION FOR SUSTAINABLE DEVELOPMENT

Climate Resilience

Webinar Series for Greater Monrovia:

Managing Current and future risks using earth observation

Webinar 2: Assessing the risks of a changing climate

Welcome

climate resilience
eo4sd

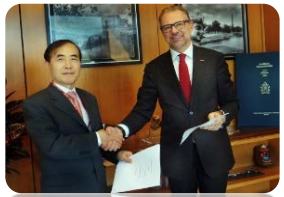
Collaboration with MDBs & Local counterparts

earth observation for sustainable development

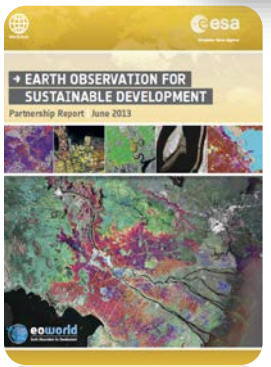
World Bank, Dec 2015

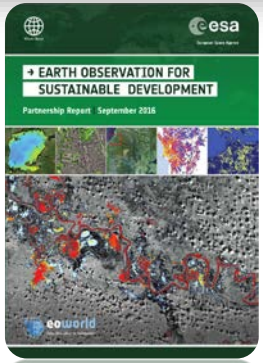
THE WORLD BANK

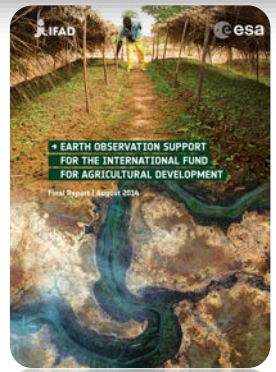
ADB



Asian Development Bank, Nov 2016







EO4SD 80+ projects showcasing EO products with MDBs (2011-2019)

Global Development Assistance (GDA) programme (2020 – 2024)

agriculture and rural development eo4sd

urban development eo4sd

water resources management eo4sd

disaster risk reduction eo4sd

marine resources eo4sd

climate resilience eo4sd

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/ 14:00 GMT

on contribute to climate resilience?

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e examples relating to the City of Monrovia.

Webinar 02: 8 April 2021 / 14:00 GMT

Assessing the risks of a changing climate

Understand key climate risk concepts and how
screening tools to identify and assess climate
and guidelines.

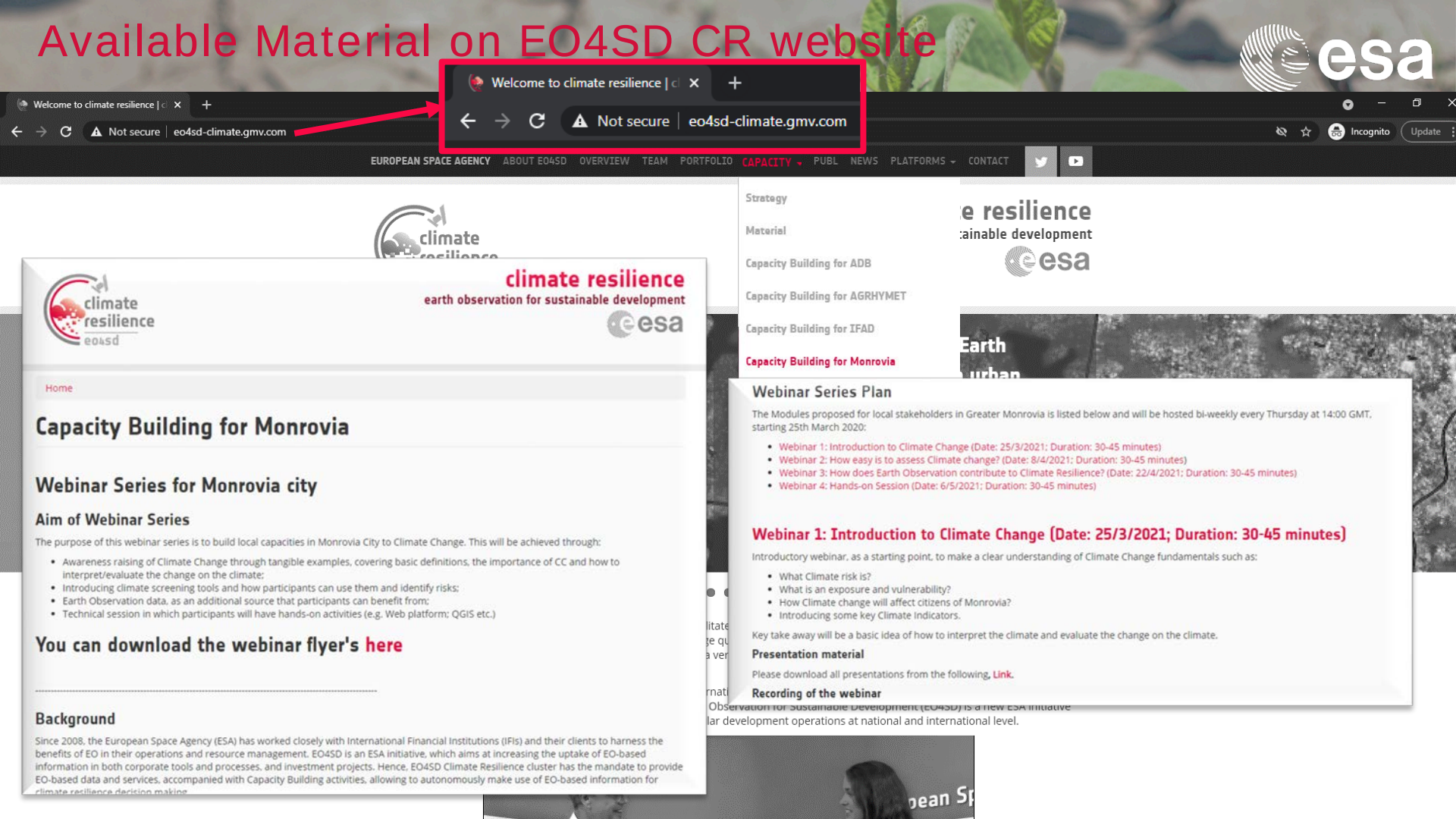
with current policy

May 2021 / 14:00 GMT

ided tutorial

Build technical capacity to use existing platforms, software and tools, and EO
climate data sources (including the E04SD Platform).

Available Material on EO4SD CR website



t Monrovia: Managing current and g earth observation

Webinar 03: 22 April 2021 / 14:00 GMT
How does earth observation contribute to climate resilience?

Understand how earth observation can inform and facilitate climate resilient development, using tangible examples relating to the City of Monrovia.

Webinar 02: 8 April 2021 / 14:00 GMT
Assessing the risks of a changing climate

Understand key climate risk concepts and how to make use of existing climate risk screening tools to identify and assess climate risks, consistent with current policy and guidelines.

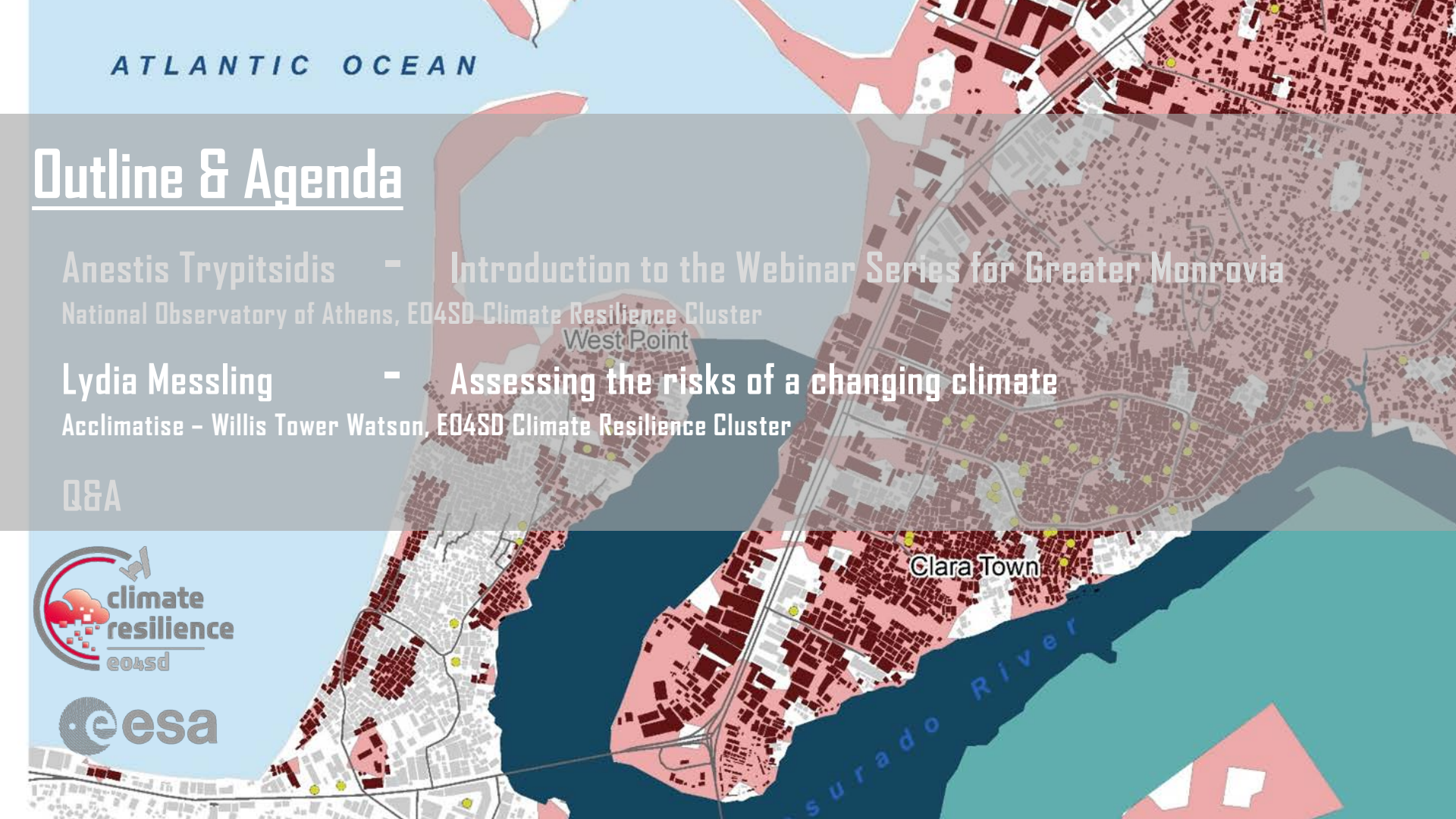
Webinar 04: 8 May 2021 / 14:00 GMT
Guided tutorial

Build technical capacity to use existing platforms, software and tools, and EO climate data sources (including the EO4SD Platform).

Webinar - Housekeeping

- Webinars will be recorded & executed through Zoom Webinar
- Webinar Recordings and Content will be made available (EO4SD CR website);
- Interaction with participants (Q&A function of Zoom)
- Able to speak during the Q&A

For any further questions please contact us: atrypitsidis@noa.gr



Outline & Agenda

Anestis Trypitsidis – Introduction to the Webinar Series for Greater Monrovia

National Observatory of Athens, EO4SD Climate Resilience Cluster

Lydia Messling – Assessing the risks of a changing climate

Acclimatise – Willis Tower Watson, EO4SD Climate Resilience Cluster

Q&A

climate resilience eo4sd

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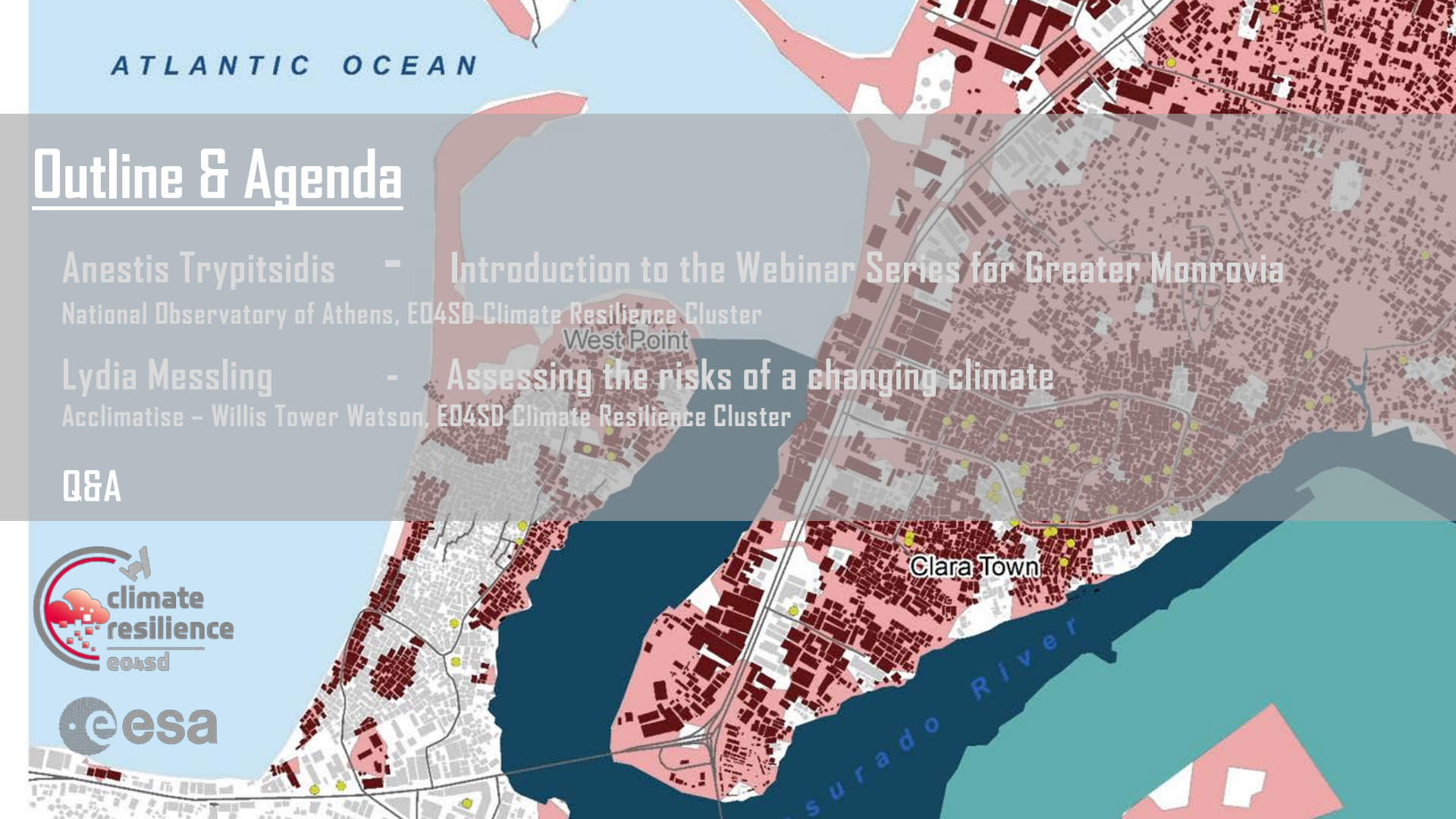

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→ EARTH OBSERVATION FOR SUSTAINABLE DEVELOPMENT

Climate Resilience

Assessing the risks of a changing climate

climate resilience
eo4sd

Dr Lydia Messling

Willis Towers Watson

Webinar 02: 8 April 2021 / 14:00 GMT

Assessing the risks of a changing climate

Understand key climate risk concepts and how to make use of existing climate risk screening tools to identify and assess climate risks, consistent with current policy and guidelines.

Contents

1. Introduction & recap
2. Key climate risk concepts
3. Identifying and assessing climate risks
    - Screening tools
    - Approaches
    - Good practice examples
4. Current policy and guidelines for Monrovia

Climate risks: Monrovia

Health risks increased owing to coastal erosion.

Donor-funded WASH facilities were constructed in 2014 in West Point Township. These were destroyed in 2016 by the impacts of coastal erosion.

This reduced access to sanitation, increased contamination of the environment and water resources, and increased risk of disease.

Education provision undermined by impacts of coastal erosion

D. M. Mmac Bee Christian Baptist School System in New Kru Town was destroyed in 2020 by the impacts of coastal erosion, reducing the availability of teaching facilities.

Coastal erosion at West Point Township has destroyed recently built sanitation facilities

Source: Shout-Africa.com, 2021

Coastal erosion at New Kru Town destroyed a school.

Source: The New Dawn Liberia, 2021

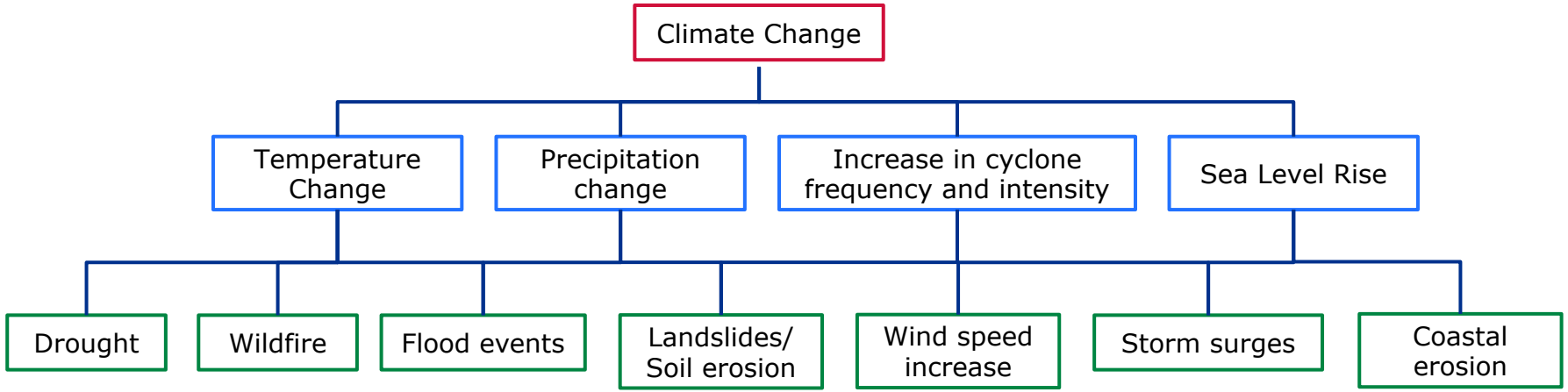
https://www.shout-africa.com/news/liberia-sea-erosion-destroys-several-sanitation-facilities/
https://thenewdawnliberia.com/kru-town-residents-to-petition-weah-legislature-u-s-embassy/

Impacts of Climate Change

The impacts of climate change

- Primary climate change drivers (e.g. temperature change) leads to changes in associated hazards.

- Climate change is likely to increase the frequency and intensity of hazards such as drought and storm surge.



Impacts of Climate Change

Cascade of effects

A single climate driver can cause a cascade of effects at the asset level and throughout systems:

Climate driver

Rising temperatures

Impact

Equipment performance
Infrastructure stress
Workforce
Natural systems e.g. wildlife and ecology
Communities

Consequence for performance

Operations
Financial and Legal
Health and Safety
Environmental and Social
Regulatory compliance
Reputation

2. Key climate risk concepts

Terminology

The IPCC's Fifth Assessment Report (AR5) defines risk as follows:

*"The **probability** or **likelihood** of the occurrence of hazardous events or trends multiplied by the **impacts (or consequence)**, if these events or trends occur."*

In a climate change context, the probability of adverse consequences (risk):

*"…results from the interaction of **vulnerability** (of the affected system), its **exposure** over time (to the hazard), as well as the (climate-related) **hazard*** and the likelihood of its occurrence."

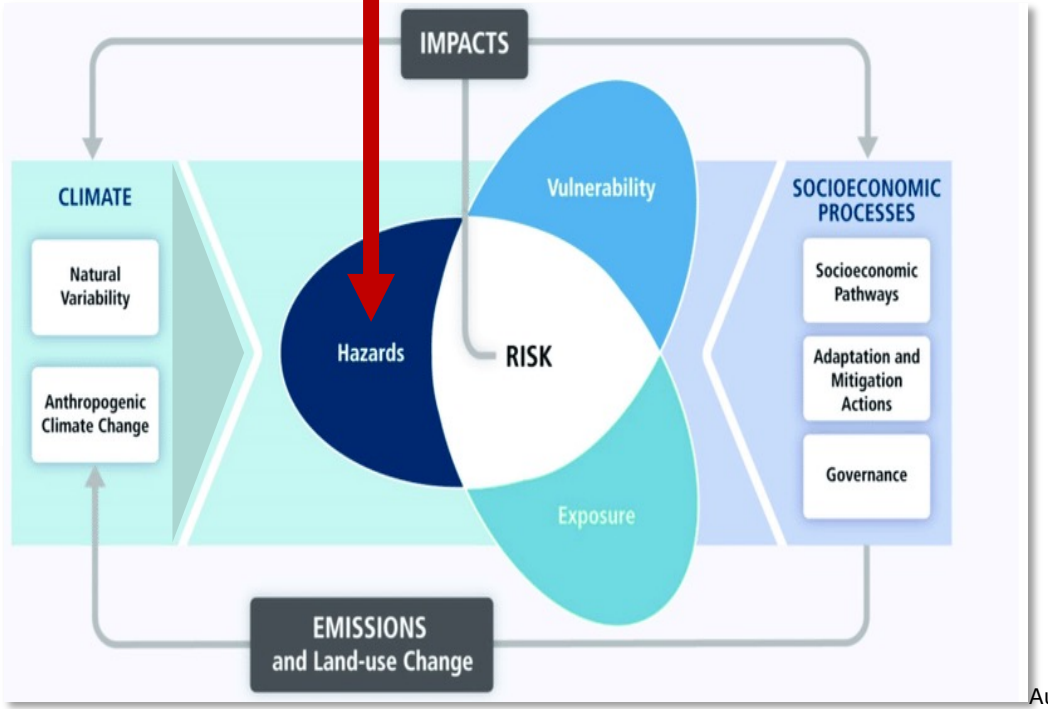
Risk = Probability X Consequence

Impacts of Climate Change

Risk = Probability X Consequence

Hazard

"Climate-related **physical events or trends** or their physical impacts."

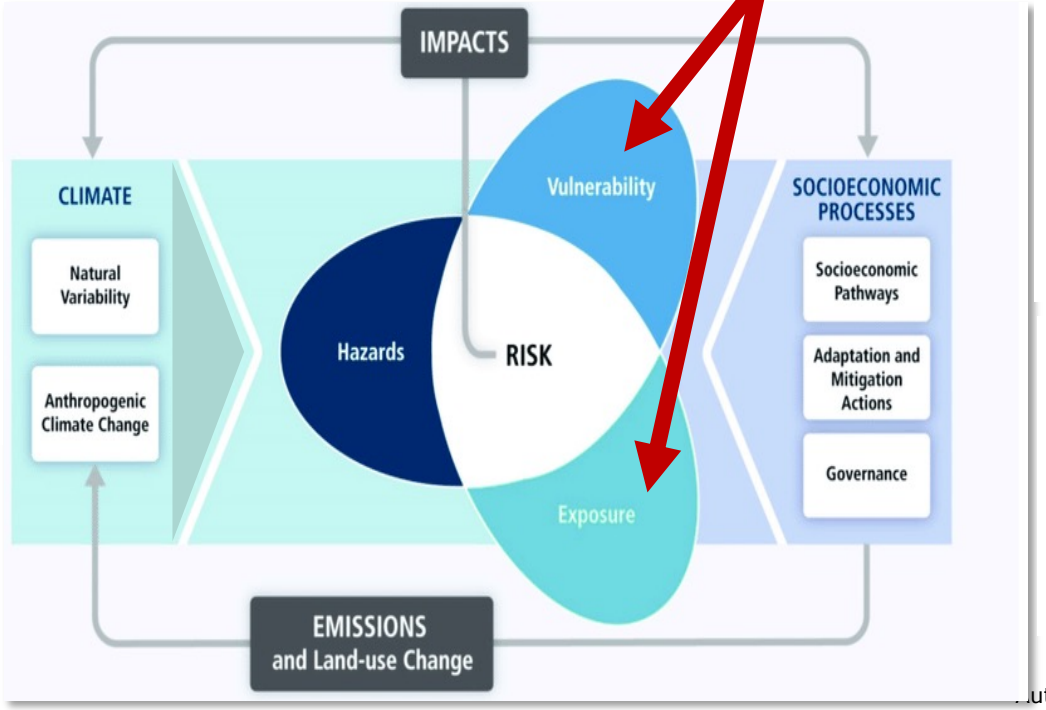


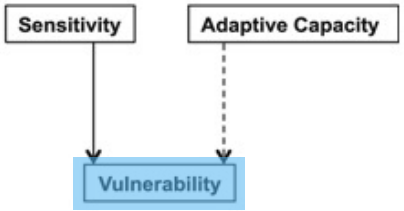
Impacts of Climate Change

Risk = Probability X Consequence

Vulnerability

"The **propensity or predisposition** to be adversely affected. Vulnerability encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt."





IPCC 2014 Paradigm

Sensitivity

How much change affects you

Adaptive capacity

How much you can change to change

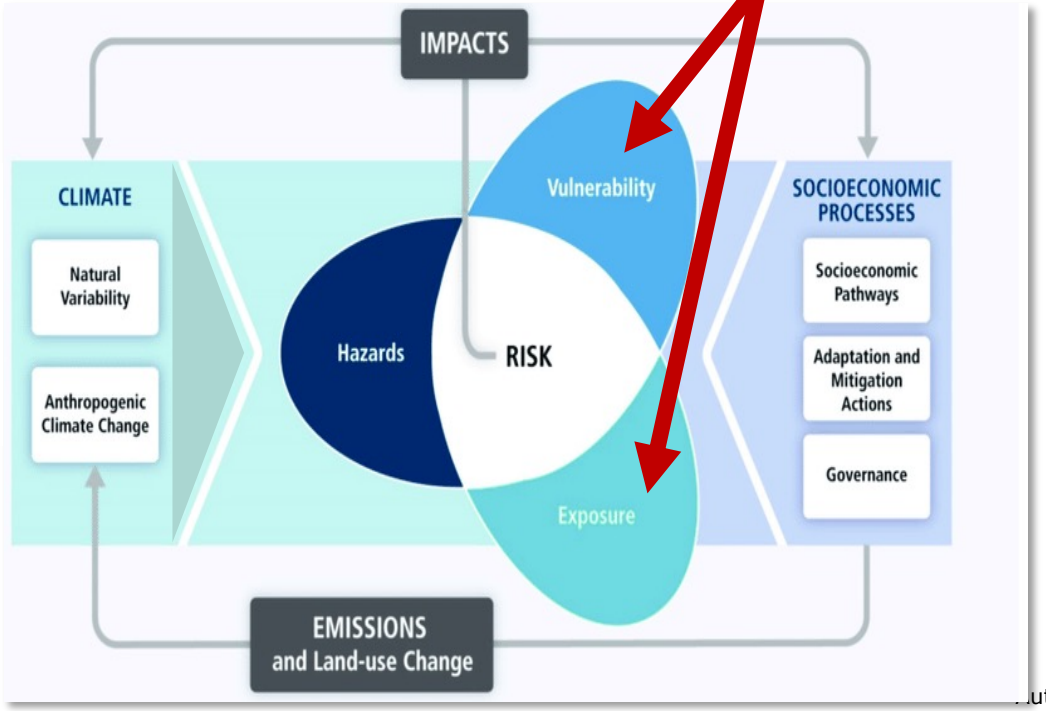
Sharma & Ravindranath

Impacts of Climate Change

Risk = Probability X Consequence

Exposure

"The **presence** of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected."



Sharma & Ravindranath

Elements of Climate Risk: Exposure

Elements at risk can be a system or one or more of a system's constitutive parts

"...the spatial and temporal distribution of population and assets" Miola and Simonet (2014)

Example indicators

- Population density
- Number of fixed or mobile assets
- Share of asset portfolio

Photo by Ishan @seefromthesky on Unsplash

Elements of Climate Risk: Vulnerability

a. Sensitivity

'Factors that directly affect the consequences of a hazard.' GIZ Sourcebook

Example indicators

- Age and gender
- Income
- Level of water demand (incl. critical thresholds if applicable)

Photo by Charl Folscher on Unsplash

Elements of Climate Risk: Vulnerability

b. 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.' IPCC

Example indicators

- Access to knowledge (e.g. early warning systems or climate risk information pertinent to asset or system)
- Adaptation plans instituted and implemented
- Level of investment (e.g. storm hardening, social protection, health)

Photo by Dan Gold on Unsplash

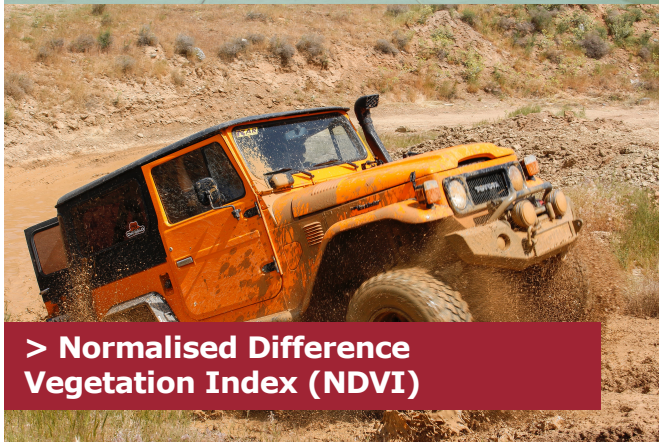


Photo by alireza nasedi on Unsplash

> Normalised Difference Vegetation Index (NDVI)

Elements of Climate Risk: Vulnerability

Adaptation

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

IPCC (2014)

Adaptive Capacity

"The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences."

IPCC (2007)

Photo by Dan Gold on Unsplash

Photo by alireza naseri on Unsplash

Elements of Climate Risk: Hazards

Hazards and their associated impacts can be divided into be:

- **Slow onset –** long-term change in climate norms and variability

Example indicators

- Average max surface air temperature
- Change in mean sea level

- **Extreme / episodic –**

Example indicators

- Frequency and magnitude of floods
- Frequency and duration of droughts

UNDP

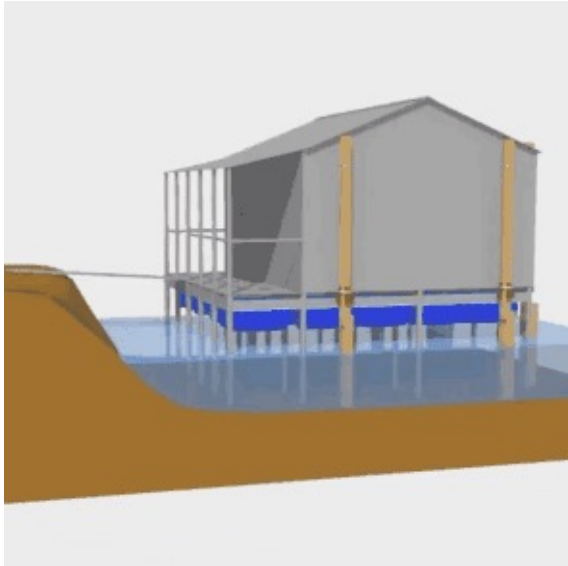
Terminology: Resilience

The IPCC's Fifth Assessment Report defines **resilience** as:

"The capacity of…systems to cope with a hazardous event or… disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation."

Climate resilience focuses on disturbances and events caused by climate change and investigates future climate-related risks which may pose new challenges for traditional risk management.

Climate-resilient development attempts to reduce vulnerability to risk by reducing exposure or sensitivity, and bolstering adaptive capacity (e.g. by improving access to and use of information).



Terminology: Resilience thinking

Urban climate change resilience processes are :

- **inclusive**, and incorporate **diverse perspectives** across stakeholder groups on climate risks and resilient solutions;
- Focus on **communities** and **ecosystems** most vulnerable to climate change;
- Address climate risk as part of a wider (socioeconomic, environmental and/or political) agenda emphasizing the importance of **inclusive governance** and **integrated planning**;

Terminology: Resilience thinking

Urban climate change resilience processes are :

- Consider **interconnections** between sectors, assets, stakeholders, plans, and governance scales;
- Are **forward-looking**, addressing existing issues while considering how climate change might **exacerbate these issues** in the future;
- Encompass climate change **adaptation**, **mitigation** and **disaster risk reduction**

3. Identifying and assessing climate risks

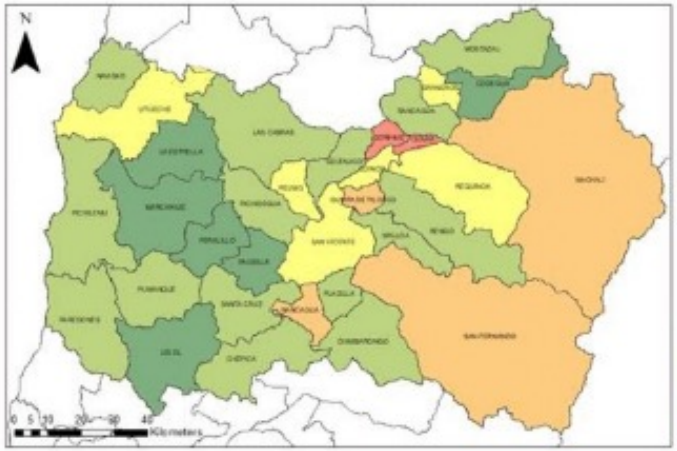
A climate resilience process: Overview

• Assessing and managing climate-related risks is now a routine component of of all MDB investment due diligence processes, and increasingly viewed as good due diligence by the private sector too.

• **There is no universal methodology** to understanding and managing climate risks, but good approaches share common aspects;

• The appropriate strategy will depend on the type of asset, geographical setting, asset lifecycle, supply chain characteristics, criticality, capacity etc.

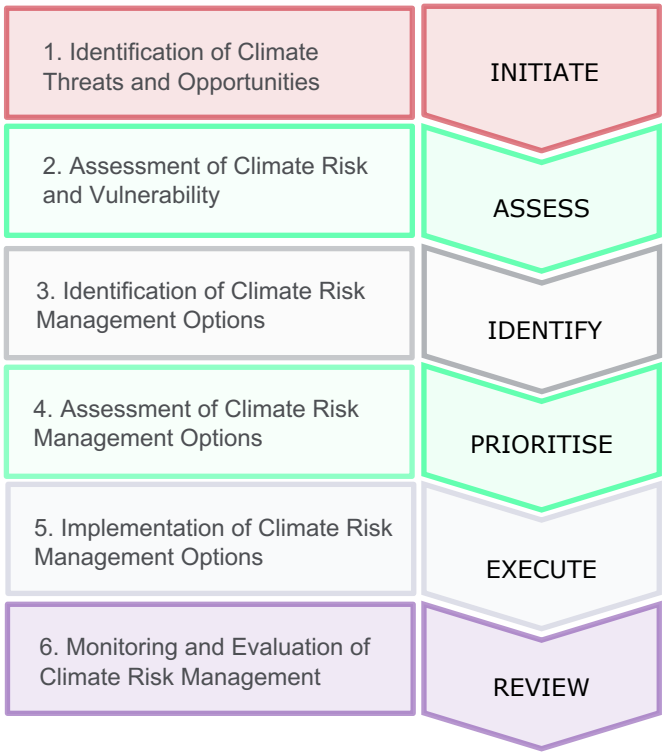
• Any strong adaptation and resilience plan should **be robust to a range of future climate scenarios, with in-built flexibility.**



District-level climate risk rating in Chile, using over 30 indicators of exposure, hazard and vulnerability. (Source: E2BIZ/Acclimatise, 2019).

A climate resilience process: Overview

This climate resilience process is broken down into 6 stages which aligns with a number of risk assessment frameworks.



A climate resilience process: Stage 1

Identify Climate Threats and Opportunities

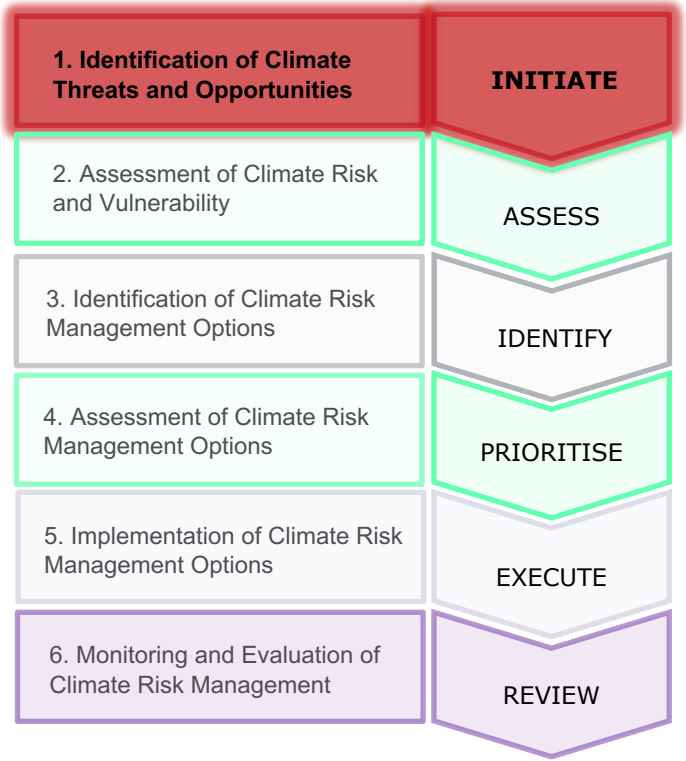
The first stage explores vulnerability to current and future weather and climate.

This involves:

A. Identifying observed severe weather impacts

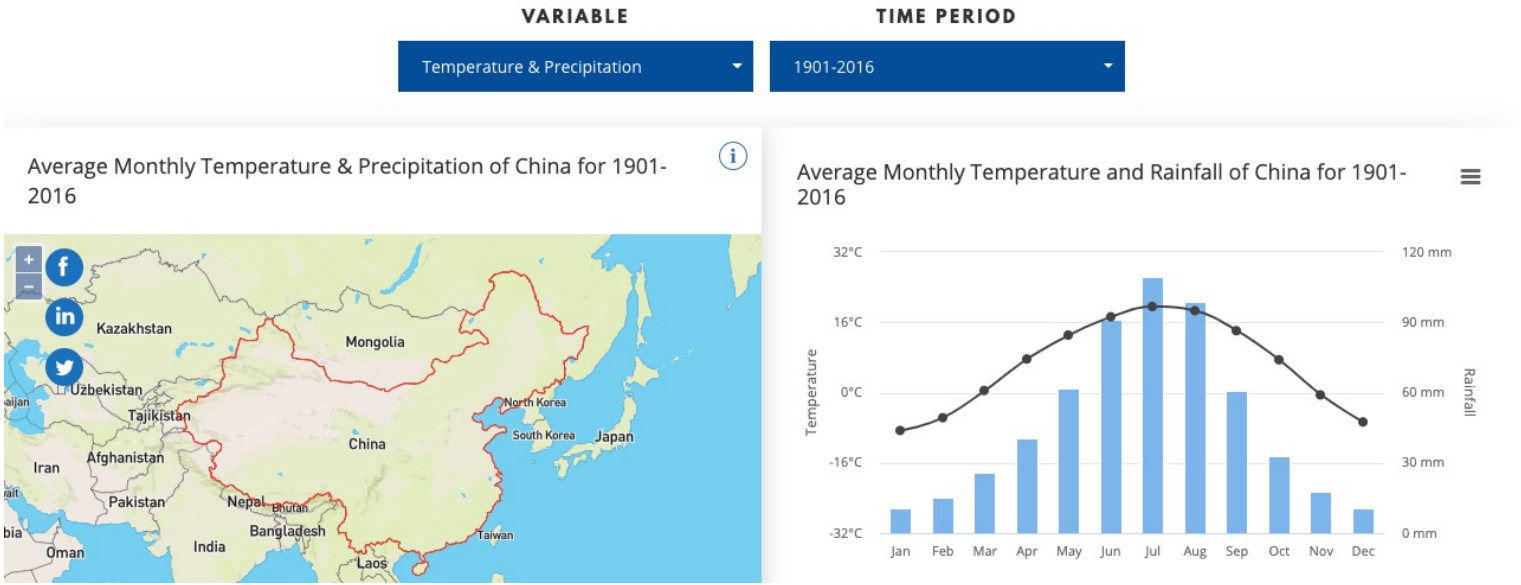
B. Exploring current vulnerability to weather and climate, and

C. Identifying critical thresholds, e.g. number of days disruption.



Datasets and tools

- Climate Change Knowledge Portal

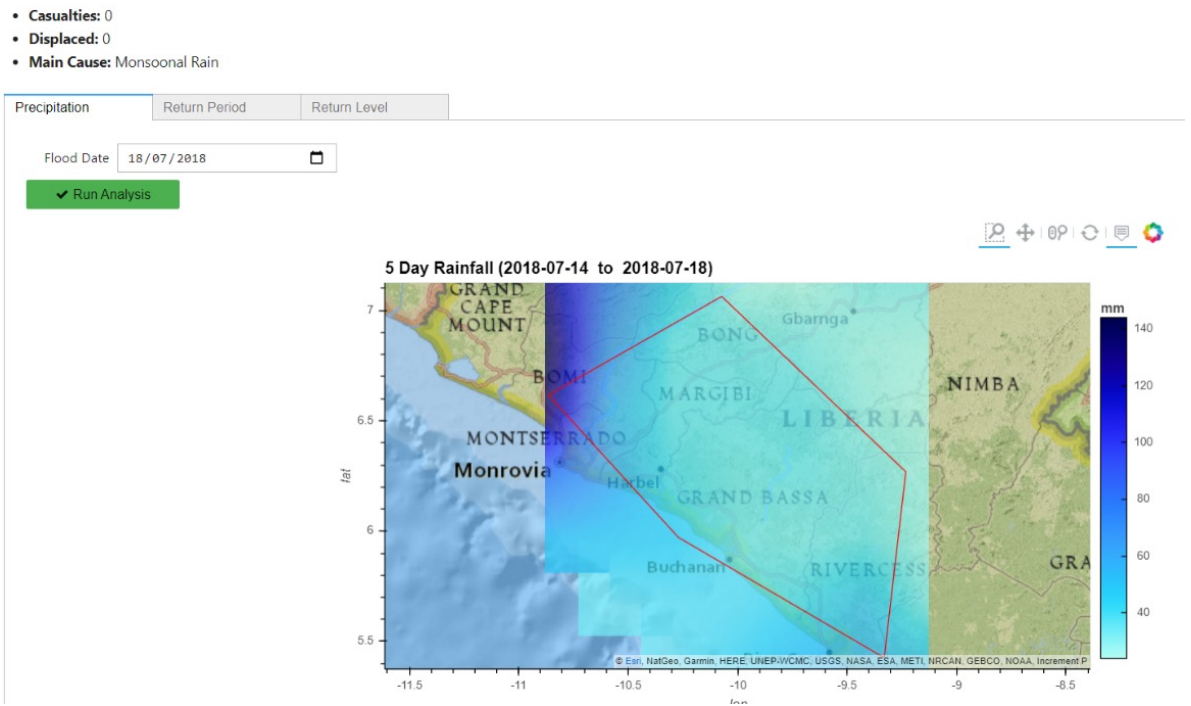


A climate resilience process: Stage 1

Datasets and tools

EO4SD Rainfall Explorer

- Global extreme rainfall and rainfall return period data.
- Baseline only
- Map and plot extreme rainfall statistics for past major flood events

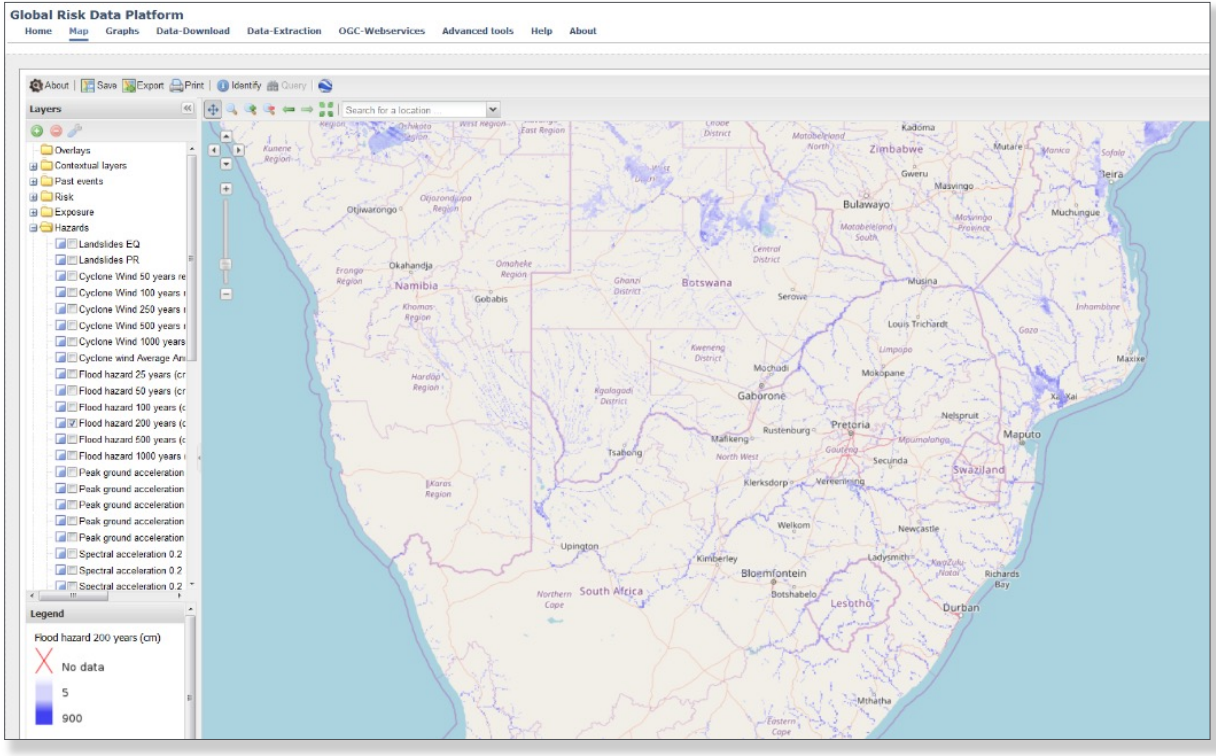


A climate resilience process: Stage 1

Datasets and tools

Global Risk Data Platform

- Global natural hazard and risk risk data
- Baseline only
- Visualise, extract, and download data

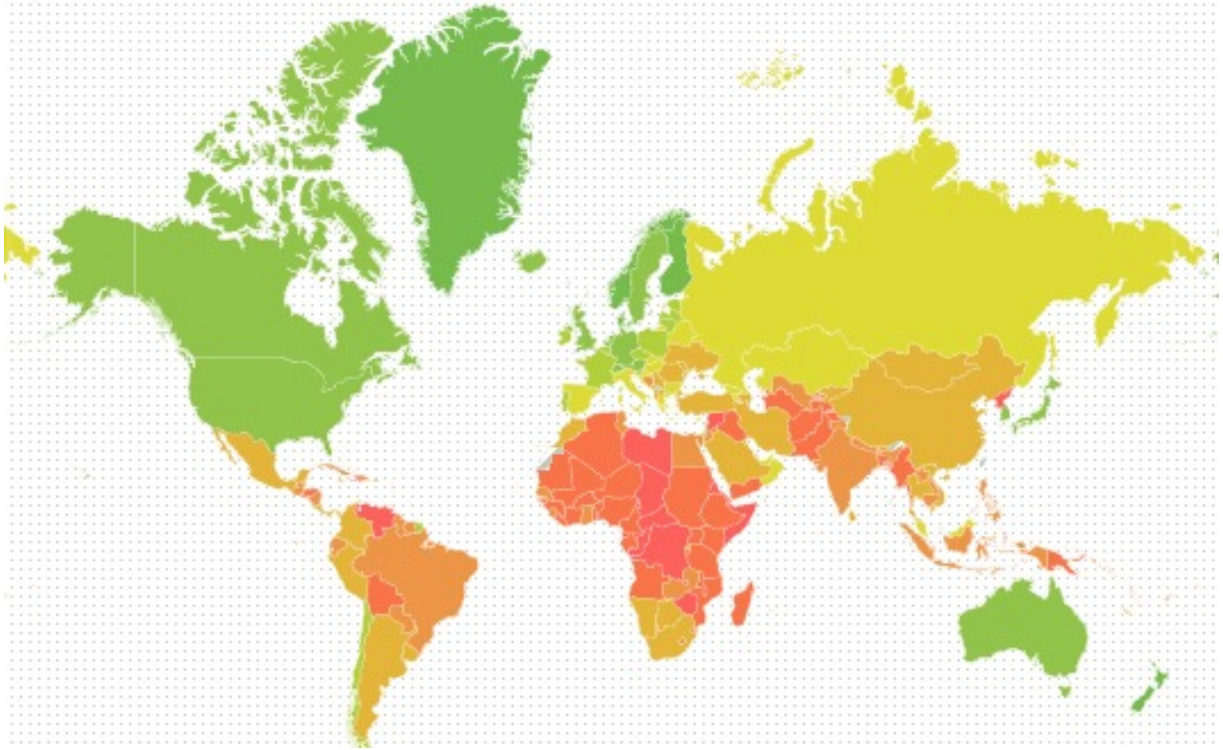


A climate resilience process: Stage 1

Datasets and tools

ND GAIN Country Readiness Scores

Since 1998, the University of Notre Dame has published an annual Index based on countries' vulnerability to climate and other risks, and their readiness to build resilience.



A climate resilience process: Stage 1

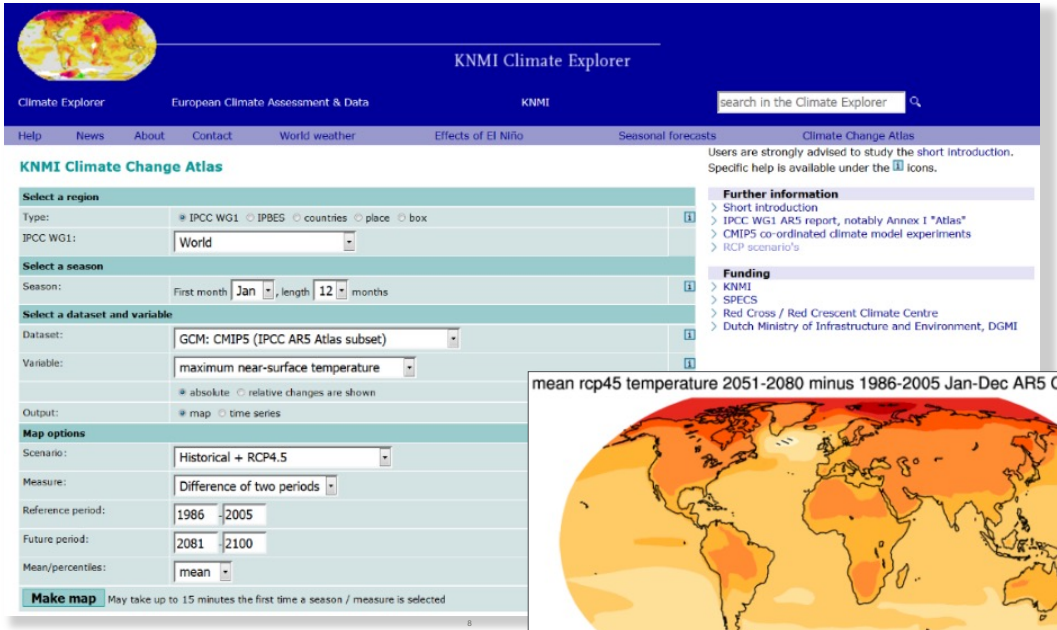
Datasets and tools

KNMI Climate Change Atlas

The latest observed, reanalysis and climate projection data accessible through an easy-to-use user interface

Includes the following core IPCC projection variables, as well as multiple extreme parameters:

- Near-surface min/max temperature
- Precipitation
- Evaporation, transpiration, sublimation
- P-E, net water flux
- Moisture content of soil layer
- Humidity (specific and relative)
- Downward solar radiation
- Air pressure at sea level



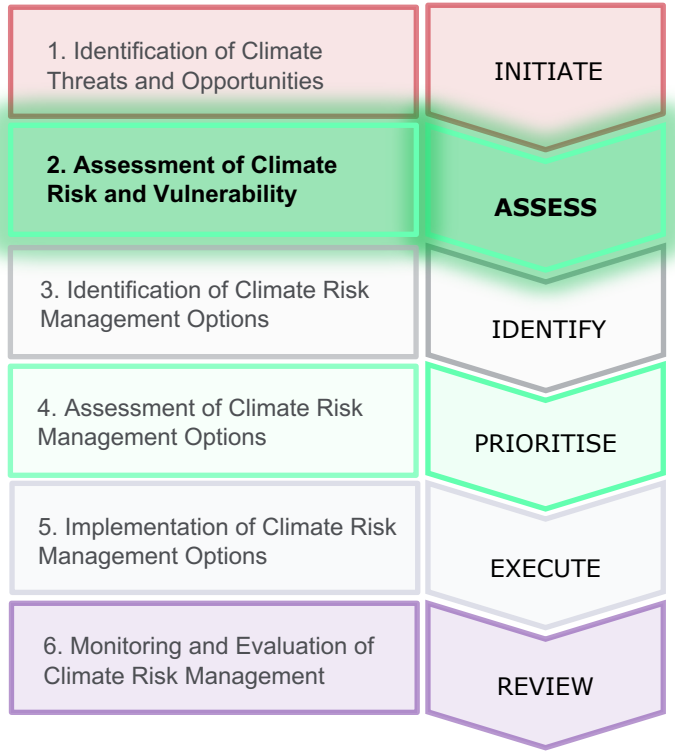
A climate resilience process: Stage 2

Assess climate risk and vulnerability

This stage examines current and future climate change risks. It helps to identify opportunities arising from climate change, and provides information on how to assess adaptive capacity and cope with uncertainty.

This involves:

- Identifying future threats and opportunities
- Scoring and prioritising current and future risks



A climate resilience process: Stage 2

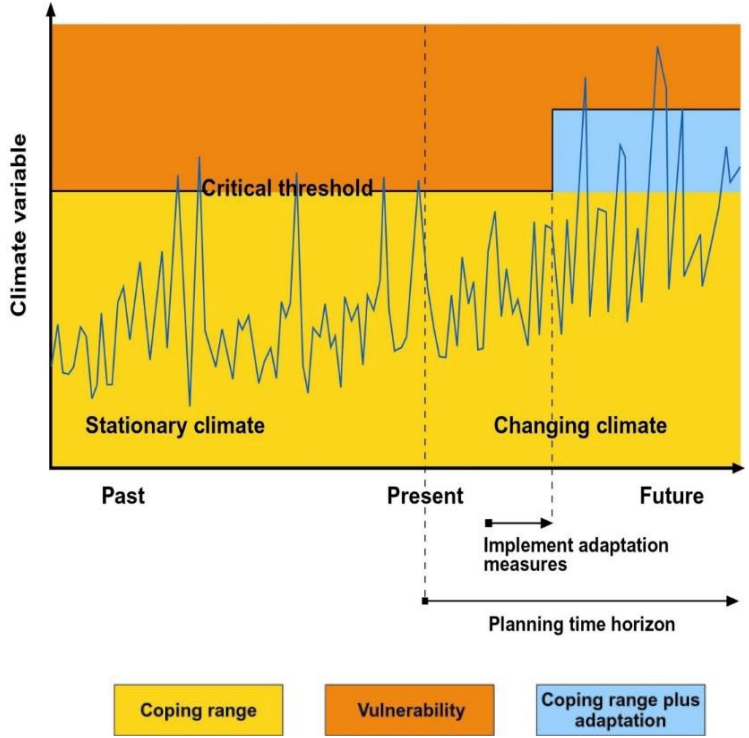
The performance of a wide range of assets can be affected by climate.

The sensitivity of assets means that unless adaptation occurs, they may have to function within tighter margins owing to effects of both chronic warming and acute (extreme) events.

Identifying **critical climate-related Thresholds** is a vital step in understanding Vulnerabilities and building resilience: When does ‘tolerable risk’ become ‘intolerable risk’, and how could this change in a warming world?

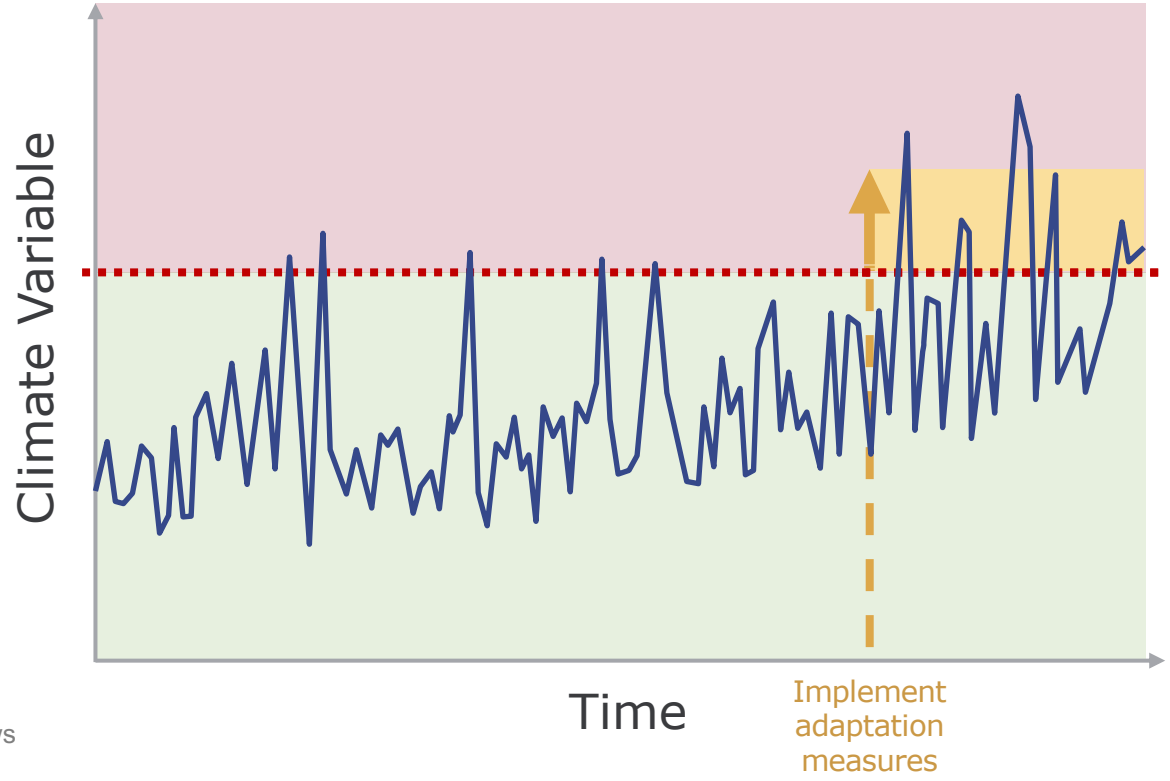
For example:

- Cooling water requirements
- Pollution control / discharge consents
- Equipment efficiencies sensitive to temperature changes



(Willows and Connell, 2003)

A climate resilience process: Stage 2



Adapted from Willows and Connell, 2003

A climate resilience process: Stage 2

Identify future threats and opportunities

Possible threats and opportunities from future climate change can be categorised by business function or by sector:

- Typical business functions might include: markets, processes, logistics, people, premises and finance.
- Sectoral examples could include agriculture, finance, health, retail or oil & gas.

	Threats (negative impacts)	Opportunities (positive impacts)
Finance	*Increased insurance premiums*	*New market opportunities*
Premises	*Repeat flooding*	*Opportunity to relocate*

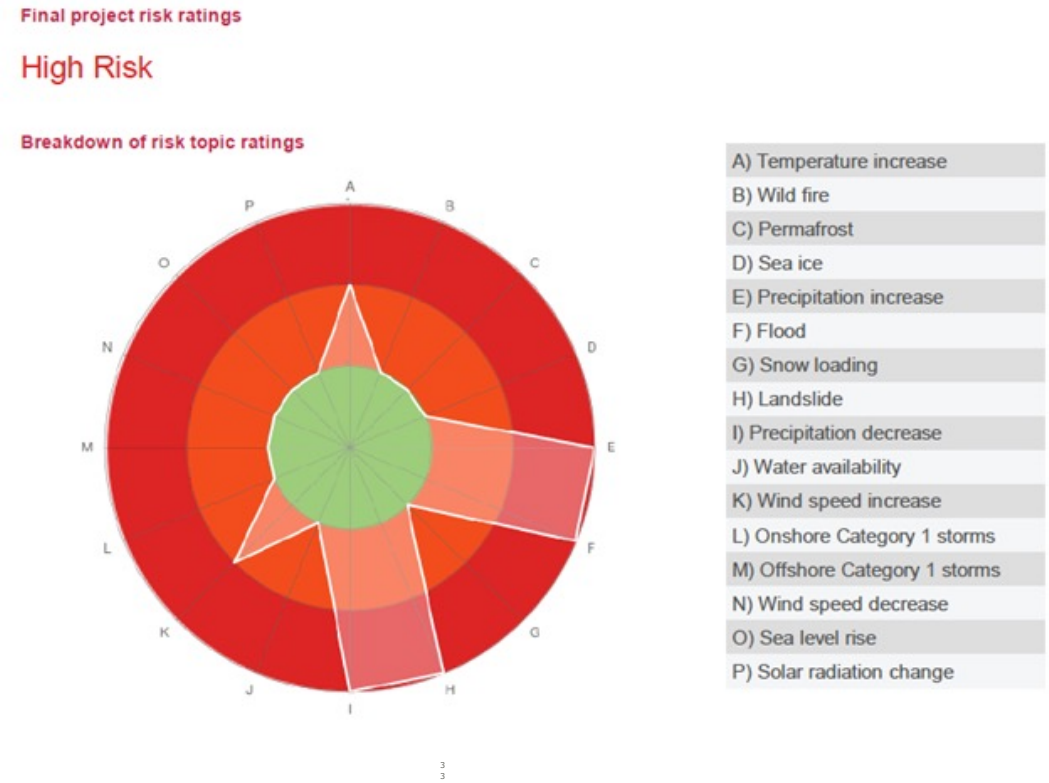
Photo by elias on Unsplash

A climate resilience process: Stage 2

Datasets and tools

Aware™

- High-level climate risk screening for individual assets or multi-component projects.
- Combines GIS database of present day and future hazards with sector sensitivity to changes in those hazards.
- Automatically-generated output report and radar summary plot, describing key risks, implications, and prompt questions.



A climate resilience process: Stage 2

Score and prioritise current and future risks

A qualitative risk assessment of the threats from current and projected future climate can be used to evaluate the risk.

A risk matrix provides a template to calculate the risk, using the following approach:

Risk = Consequence x Likelihood

		Consequence			
		Low (1)	Medium (2)	High (3)	Extreme (4)
Likelihood	Almost certain (4)				
	Likely (3)				
	Possible (2)				
	Unlikely (1)				

A climate resilience process: Stage 2

Climate and disaster risk screening tools to assess hazard exposure:

- ✓ Identify risks and inform stakeholder dialogue
- ✓ Inform climate-smart project design
- ✓ Boost climate resilience outcomes / co-benefits

https://climatescreeningtools.worldbank.org/

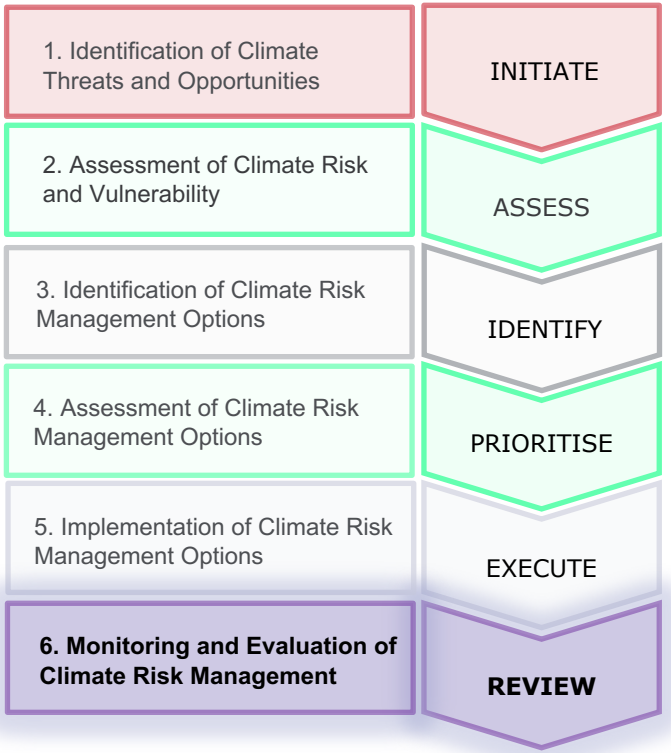
A climate resilience process: Stage 6

Monitor and evaluate climate risk management

Assessing progress and performance is fundamental to most evaluations. It is often useful to quantify and measure this.

It is important to consider what you are measuring against.

One way to view progress and performance is to evaluate against examples of ‘good practice’.



A climate resilience process: Stage 6

Evaluate against examples of ‘good practice’

The characteristics of good climate resilience can be a useful way to measure performance. These can form the basis of an evaluation criteria alongside the assessment of project-specific objectives.

The following 6 ‘guiding principles’ (DEFRA, 2010) provide a useful starting point and emphasise that climate resilience interventions should be:

Sustainable

Proportionate and integrated

Collaborative and open

Effective

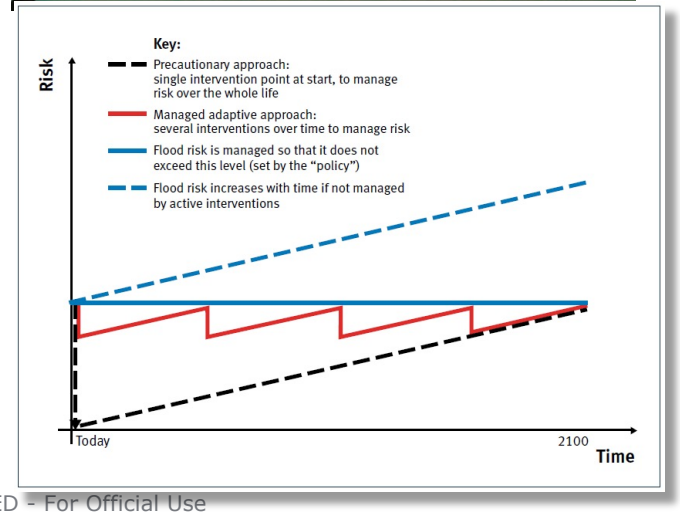
Efficient

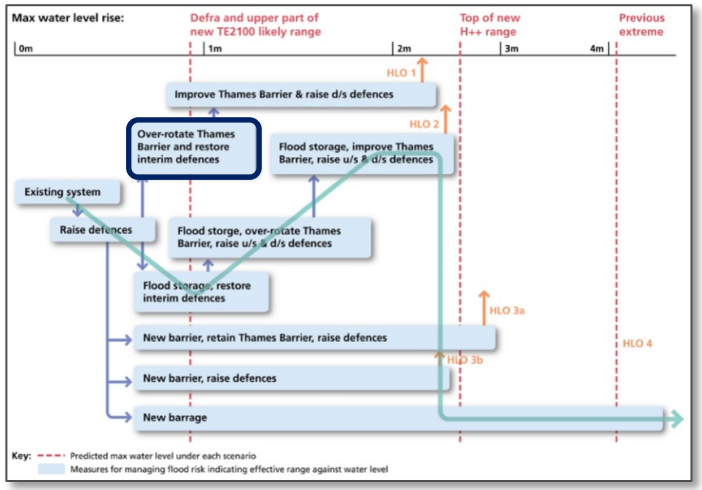
Equitable

DEFRA (2010). www.adaptationscotland.org.uk/what-adaptation/principles-good-adaptation

Examples of good practice

Simple adaptation pathway: Thames Estuary 2100 project



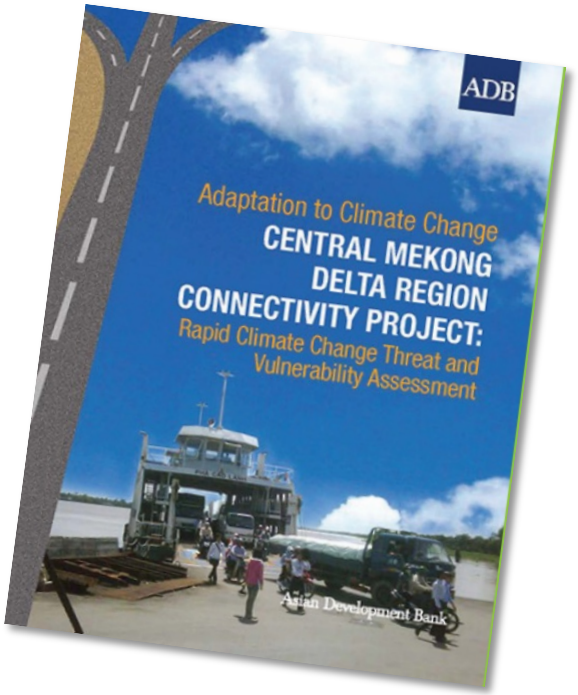


Managing flood risk through the century using the TE2100 managed adaptive approach allows changes in expected conditions, as they occur, to be addressed

Building road resilience in the Mekong Delta

An assessment of an ADB supported bridge and road project in Vietnam revealed that the project was exposed to projected increases in flooding that would increase erosion of embankments, scouring of road foundations, waterlogging, amongst other impacts.

The project incorporated a phased approach to building the resilience of the asset, that included applying a +0.3m factor to embankments so that they could cope with future flood hazard.



Strengthening construction standards in Texas

Adjusting construction standards to take account on climate change in Texas

Following 1-in-500 year magnitude flooding associated with Hurricane Harvey – that damaged 31,000 homes and caused a total $180bn of damage - Harris County (Houston) issued new construction regulations. These stipulated that new structures exposed to 1-in-100 year flood hazard must be built to 1-in-500 year flood standards.

Approaches

USAID Framework for Understanding and Addressing Climate Change

This framework facilitates the systematic inclusion of climate considerations in development decision-making

The climate-resilient development framework is designed to promote actions that ensure progress toward development goals by including climate stressors, both climate variability and climate change.

Five-stage, systematic process for understanding and prioritizing current and projected climate-related vulnerabilities-

- **Stage 1**: **Scope** and development context
- **Stage 2**: **Assess** vulnerabilities and systems
- **Stage 3: Design actions**
- **Stage 4: Implement and manage** actions
- **Stage 5: Evaluate and adjust** strategy or project

Source: USAID, 2014. Climate Resilient Development: A Framework for Understanding and Addressing Climate Change

Climate ADAPT Urban Adaptation Support Tool

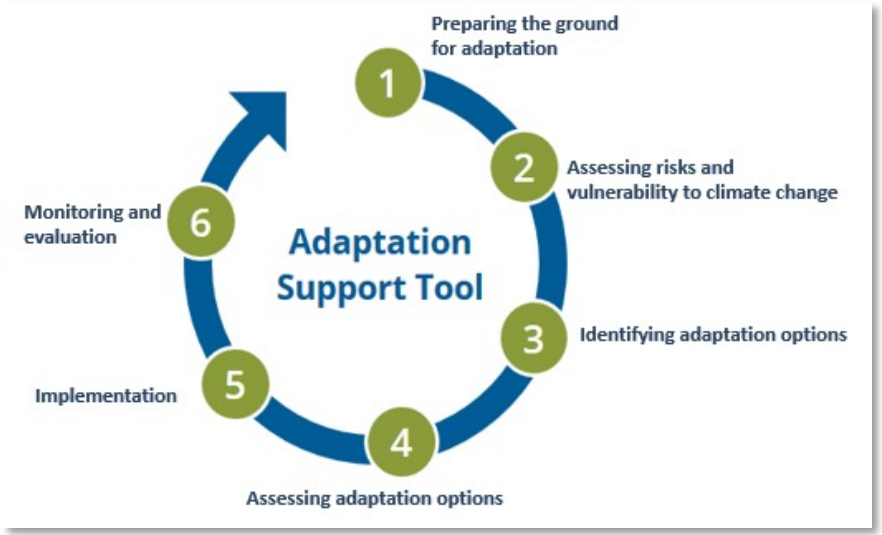
Application: Development of municipal adaptation and resilience plans.

A process to help:

- **Explore** risks and vulnerability to current and future climate
- **Identify** and assess adaptation options
- **Develop** and implement a climate change adaptation strategy and/or action plan
- **Monitor** results

Success factors include:

- Strong leadership and mandate
- Collaboration: across departments and sectors and between service providers and users
- Learning from the experience of others

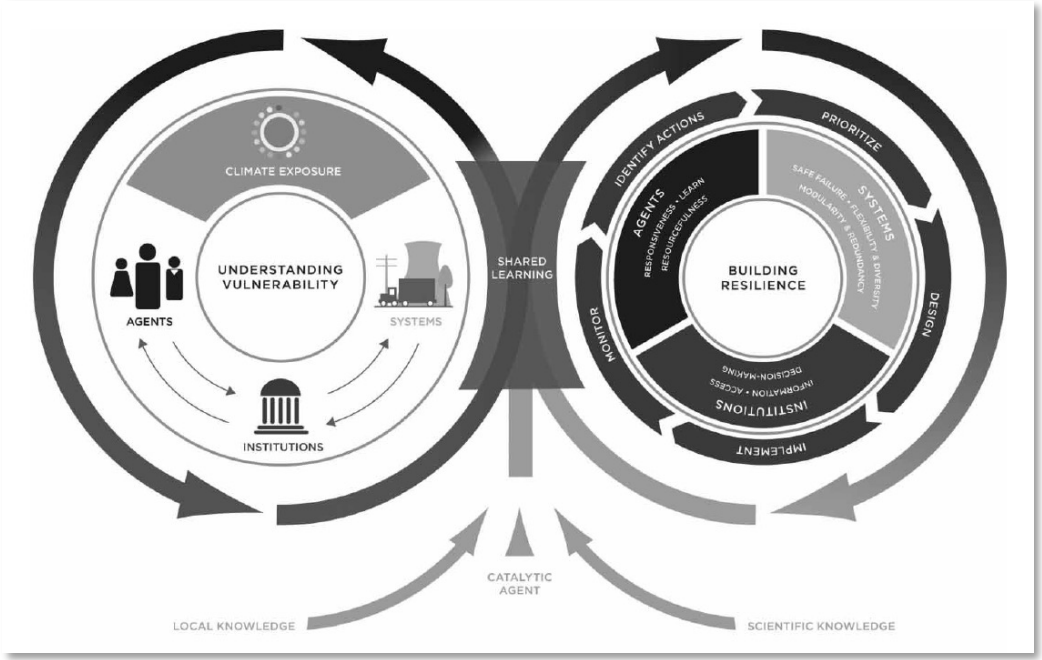


✓ **Standard tool adopted by signatories of the Covenant of Mayors**

Covenant of Mayors for Climate & Energy EUROPE

Source: The Urban Adaptation Support Tool. Available: https://climate-adapt.eea.europa.eu/knowledge/tools/urban-ast/step-0-0

ACCCRN's Resilience Framework



The Resilience Framework consists of three elements:

- Systems (incl. ecosystems and infrastructure)
- Agents
- Institutions

Building resilience means:

1. Strengthening systems
2. Capacity building
3. Strengthening institutions

These factors interrelate.
Resilience should focus on the most vulnerable and be operationalized through collaborative, participatory processes.

ACCCRN

TOOLS:
https://www.resilienceshift.org/tools

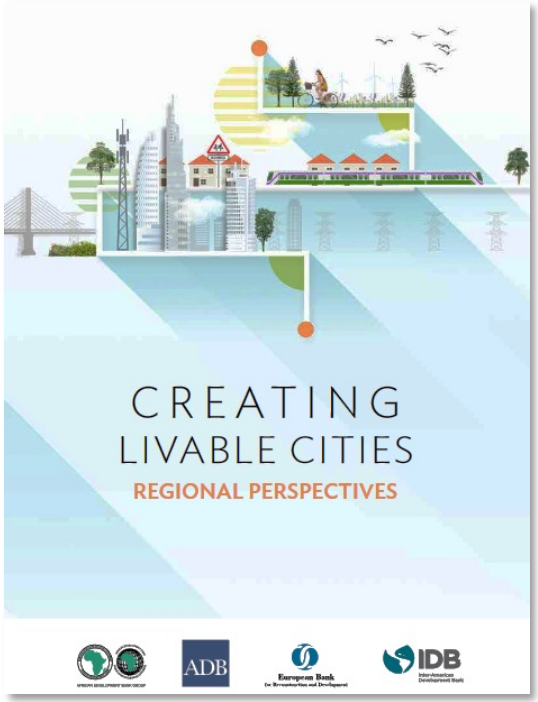
Tyler and Muench, 2012. A framework for urban climate resilience. *Climate and development* 4: 311-326

ADB Creating Liveable Cities: Regional Perspectives

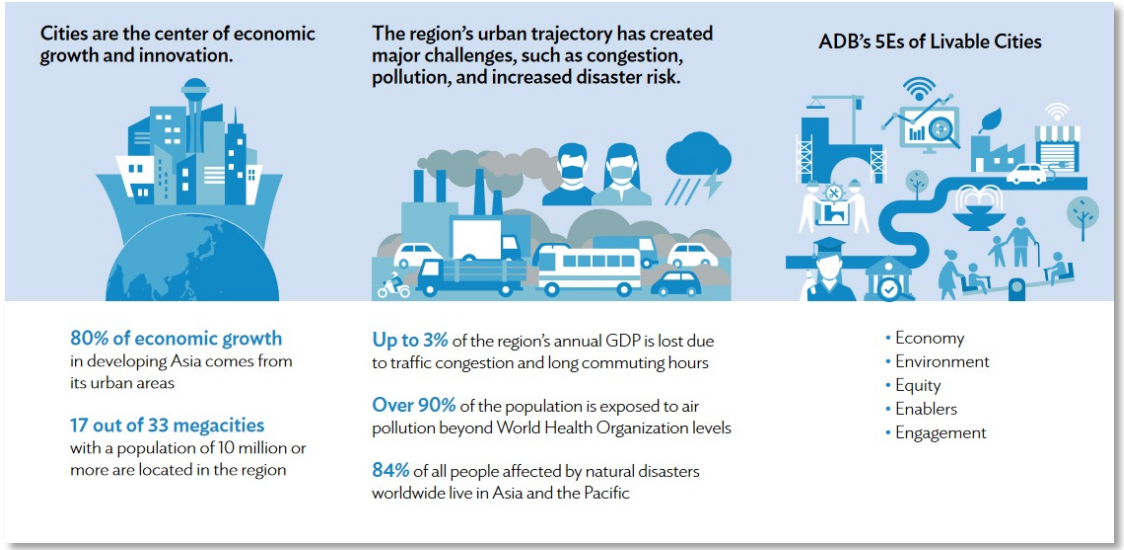
A liveable city presupposes **a city adapted to the physical impacts of climate change**.

Climate change mitigation and adaptation are sub-components of one of the '**5Es of Liveable Cities**'- Environmental Sustainability and Resilience.

- A key approach of ADB to make cities more liveable is to 'improve urban environments, climate resilience and disaster management' (ADB, 2018)
- Mitigation and adaptation are mainstreamed into urban planning and design



ADB Creating Liveable Cities: Regional Perspectives



- No specific protocols or prescriptions for how adaptation should be advanced.

Recommendations:

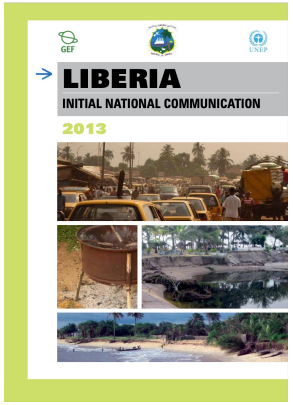
- **Structural and non-structural solutions** (incl. nature-based solutions such as 'sponge cities'),
- **Use data** (including Geographic Information Systems) to improve quality of scientific evidence informing city resilience planning and climate-proofing of infrastructure.

4. Current Policies and Guidelines for Monrovia

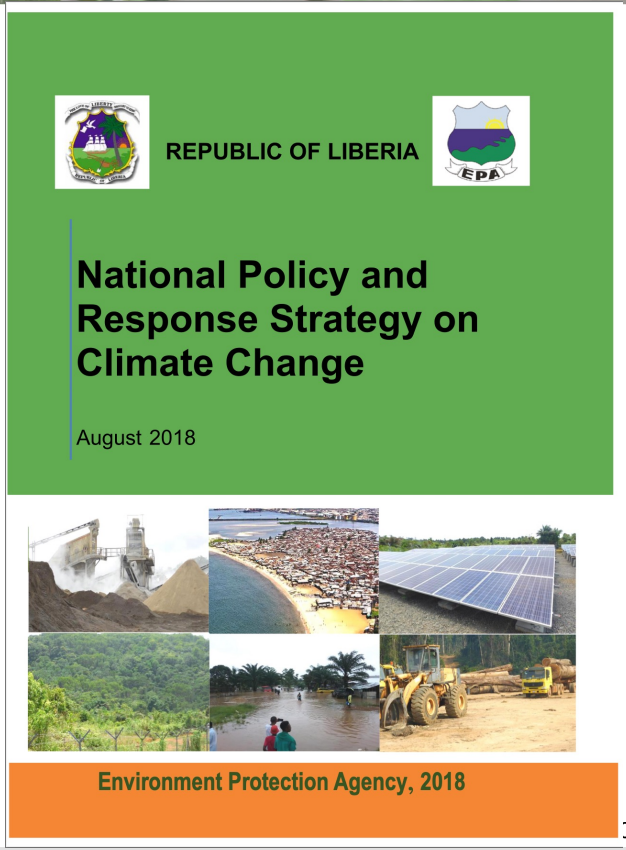
Policy Context in Monrovia

There is a set of policies that are geared towards building climate resilience.

If you were to use these tools or act upon the guidance, you may want to refer to the policies to ensure that any actions are in harmony with these policies' strategic goals.



The EPA's National Communication Plan also outlines key information and response suggestions



Policy list from: Coastal Zone's Technology Needs Assessment for Climate Change Adaptation

Summary

- The IPCC's canonical concept of climate risk comprises three major components:
  - **Exposure** (presence)
  - **Vulnerability** (propensity to be affected)
  - **Hazard** (harm)
- The physical impacts of a changing climate can trigger or exacerbate many types of risks that cities already face, related to health and wellbeing, the environment, deprivation, amongst others.
- **Risks are not inevitable**: cities can adapt and build resilience.
- Policy, regional initiatives and finance are all external drivers of action; emphasising how cities can derive co-benefits can be the clincher.

Any Questions?