

# → 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

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## **Collaboration with MDBs & Local counterparts**

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earth observation for sustainable development





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### Available Material on EO4SD CR website

🚺 Welcome to climate resilience 🛛 🕻 🗙 🐏 Welcome to climate resilience | 🖒 🗙 🛛 🕂 A Not secure eo4sd-climate.gmv.com C A Not secure eo4sd-climate.gmv.com EUROPEAN SPACE AGENCY ABOUT E04SD OVERVIEW TEAM PORTFOLIO CAPACITY - PUBL NEWS PLATFORMS - CONTACT • Strategy e resilience Material ainable development: esa Capacity Building for ADB climate resilience **Capacity Building for AGRHYMET** earth observation for sustainable development esa Capacity Building for IFAD - an fi Capacity Building for Monrovia Home Webinar Series Plan The Modules proposed for local stakeholders in Greater Monrovia is listed below and will be hosted bi-weekly every Thursday at 14:00 GMT. **Capacity Building for Monrovia** starting 25th March 2020: Webinar 1: Introduction to Climate Change (Date: 25/3/2021; Duration: 30-45 minutes) Webinar 2: How easy is to assess Climate change? (Date: 8/4/2021; Duration: 30-45 minutes) Webinar 3: How does Earth Observation contribute to Climate Resilience? (Date: 22/4/2021; Duration: 30-45 minutes) Webinar Series for Monrovia city Webinar 4: Hands-on Session (Date: 6/5/2021; Duration: 30-45 minutes) Aim of Webinar Series Webinar 1: Introduction to Climate Change (Date: 25/3/2021; Duration: 30-45 minutes) The purpose of this webinar series is to build local capacities in Monrovia City to Climate Change. This will be achieved through: Introductory webinar, as a starting point, to make a clear understanding of Climate Change fundamentals such as: Awareness raising of Climate Change through tangible examples, covering basic definitions, the importance of CC and how to interpret/evaluate the change on the climate: What Climate risk is? · Introducing climate screening tools and how participants can use them and identify risks; · What is an exposure and vulnerability? Earth Observation data, as an additional source that participants can benefit from: · How Climate change will affect citizens of Monrovia? · Technical session in which participants will have hands-on activities (e.g. Web platform; QGIS etc.) · Introducing some key Climate Indicators. Key take away will be a basic idea of how to interpret the climate and evaluate the change on the climate. You can download the webinar flyer's here Presentation material ver Please download all presentations from the following, Link, rnati Recording of the webinar Observation for Sustainable Development (E045D) is a new ESA in Background lar development operations at national and international level. Since 2008, the European Space Agency (ESA) has worked closely with International Financial Institutions (IFIs) and their clients to harness the benefits of EO in their operations and resource management. EO4SD is an ESA initiative, which aims at increasing the uptake of EO-based information in both corporate tools and processes, and investment projects. Hence, EO4SD Climate Resilience cluster has the mandate to provide

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EO-based data and services, accompanied with Capacity Building activities, allowing to autonomously make use of EO-based information for

rlimate resilience derision making







### 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.

# : 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 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).

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# Webinar - Housekeeping



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- Webinars will be recorded & executed through Zoom Webinar
- Webinar Recordings and Content will be made available (ED4SD CR website);
- Interaction with participants (Q&A function of Zoom)
  - Able to speak during the Q&A

For any further questions please contact us:

### ATLANTIC OCEAN

# <u> Outline & Agenda</u>

Anestis Trypitsidis - Introduction to the Webinar Series for Greater Monrovia National Observatory of Athens, EO4SD-Climate Resilience Cluster West Point

Lydia Messling - Assessing the risks of a changing climate Acclimatise - Willis Tower Watson, EO4SD Climate Resilience Cluster

### Q&A



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# → EARTH OBSERVATION FOR SUSTAINABLE DEVELOPMENT

### **Climate Resilience**

# Assessing the risks of a changing climate



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**European Space Agency** 

Dr Lydia Messling

Willis Towers Watson

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### Webinar 02: 8 April 2021 / 14:00 GMT

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### 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

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# 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.

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/ ESA UNCLASSIFIED - For Official Use



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.

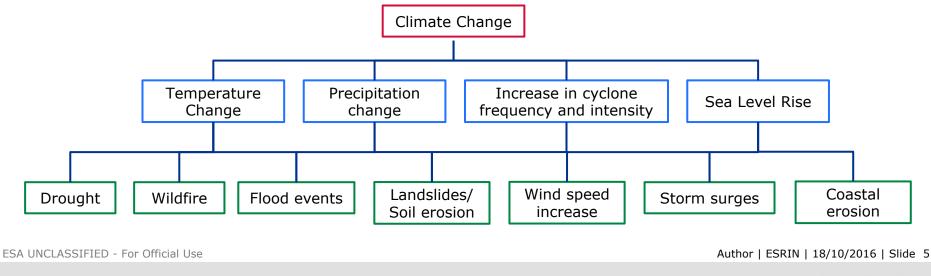
Source: The New Dawn Liberia, 2021

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### 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.





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



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### **2. Key climate risk concepts**

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### Terminology



"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** 

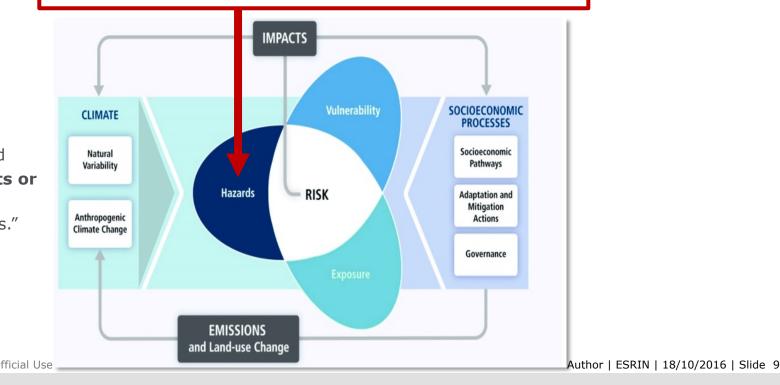
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### Risk = Probability X Consequence

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



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Esharna & Ravindrahath

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#### **Risk = Probability X** Consequence Vulnerability IMPACTS Sensitivity Adaptive Capacity "The propensity or predisposition to Vulnerability SOCIOECONOMIC CLIMATE Vulnerability be adversely PROCESSES affected. Socioeconomic **IPCC 2014 Paradigm** Natural Pathways Variability Vulnerability **Sensitivity** encompasses a Hazards RISK Adaptation and Mitigation variety of concepts How much change Anthropogenic Actions **Climate Change** and elements, affects you Governance including sensitivity **Adaptive capacity** or susceptibility to How much you can harm and lack of change to change **EMISSIONS** capacity to cope and and Land-use Change adapt."

Sharna & Ravindranath

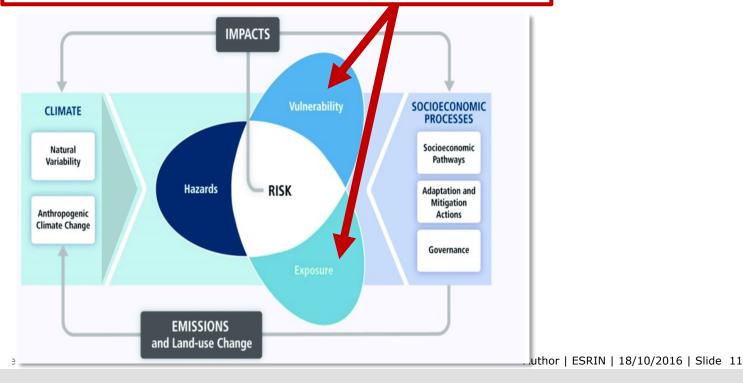
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### Risk = Probability X Consequence

### 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."



Sharna & Ravindrahath

### **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 Unspla

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### **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

**European Space Agency** 

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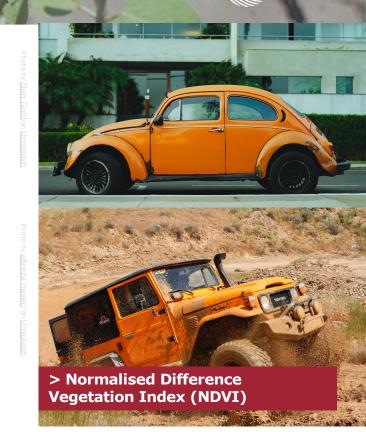
## **Elements of Climate Risk: Vulnerability**

### 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)



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# **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."

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."





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### **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

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> Exceedance of 85<sup>th</sup> %'ile of historical average July/August average temperature for 3+days (no. days/year)



UNDP

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## **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).



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## **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;

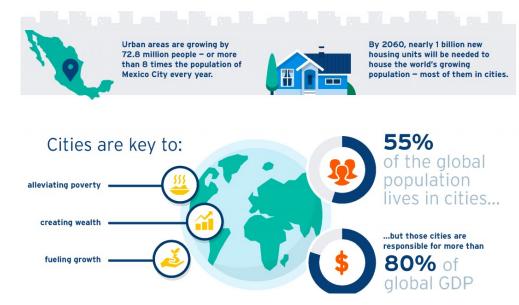


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## **Terminology: Resilience thinking**

#### 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



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### 3. Identifying and assessing climate risks

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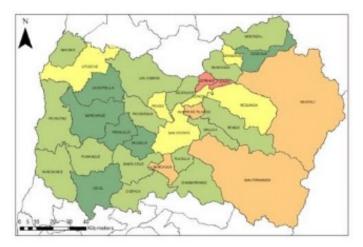
### A climate resilience process: Overview

• Assessing and managing climate-related risks is now a routine component 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).

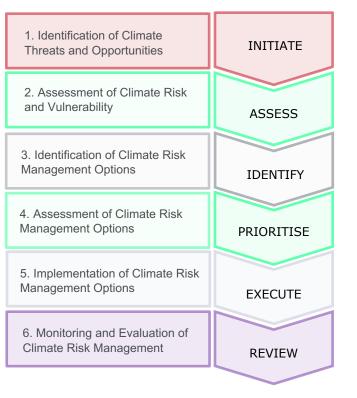
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### A climate resilience process: Overview



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



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# 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.



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#### **Datasets and tools**

Climate Change Knowledge Portal



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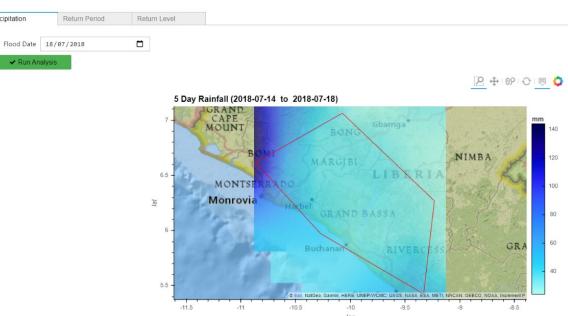
### Datasets and tools **EO4SD** Rainfall Explorer

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

Casualties: 0

Precipitation

- Displaced: 0
- Main Cause: Monsoonal Rain



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### **Datasets and tools**

**Global Risk Data Platform** 

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

**Global Risk Data Platform** Home Map Graphs Data-Download Data-Extraction OGC-Webservices Advanced tools Help About About | T Save Seport APrint | 1 Identify Layers 008 Kadon Overlays Zimbabwe Contextual layers Past events 🗃 🥅 Risk Bulawayo B Exposure Hazards Landslides EQ Landslides PR Okahandja Cyclone Wind 50 years re Cyclone Wind 100 years ( Gobabis Cyclone Wind 250 years ( Khoma Louis Trichards Cyclone Wind 500 years r Cyclone Wind 1000 years Cyclone wind Average An Flood hazard 25 years (cr Mokopane Region Flood hazard 50 years (cr Gaborone Flood hazard 100 years (c Flood hazard 200 years (c Flood hazard 500 years (c Flood hazard 1000 years North We Peak ground acceleration Upingt Spectral acceleration 0.2 Spectral acceleration 0.2 Bloemfontein Spectral acceleration 0.2 South Africa Cope Durban Legend Flood hazard 200 years (cm) X No data 5 900

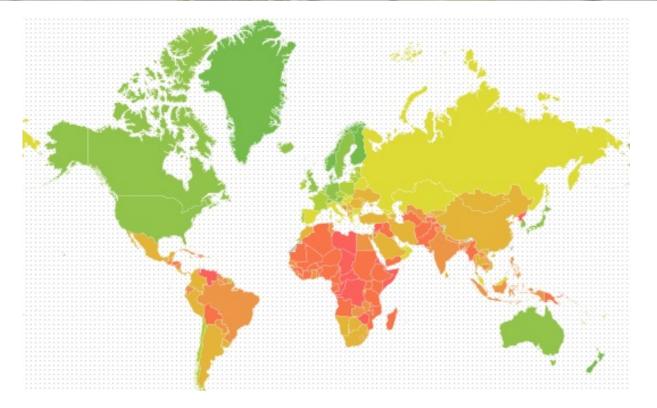
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### **Datasets and tools**

### 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.



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### **Datasets and tools**

### **KNMI Climate Change Atlas**

The latest observed, reanalysis and climate projection data accessible through an easy-touse 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 ESA UNCLASSIFIED - For Official Use

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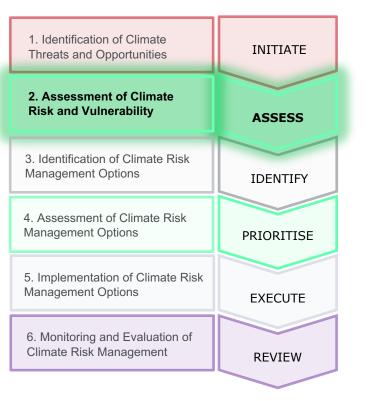
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## Assess climate risk and vulnerability

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



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

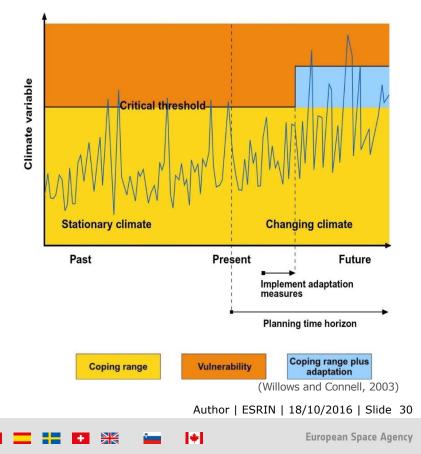
The sensitivity of assets means that unless adaptation occurs, they may have to function within tighter margins owing to effects of both chronic warming and acute (extreme) events.

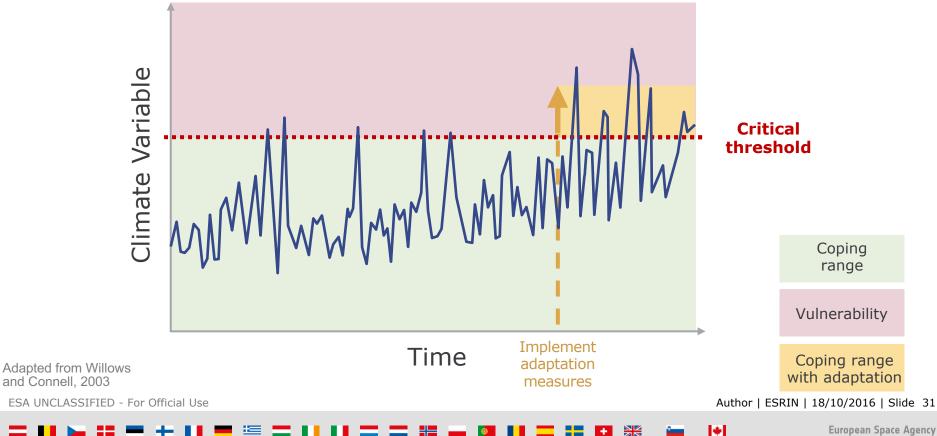
Identifying **critical climate-related Thresholds** is a vital step in understanding Vulnerabilities and building resilience: When does 'tolerable risk' become 'intolerable risk', and how could this change in a warming world?

For example:

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

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## 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



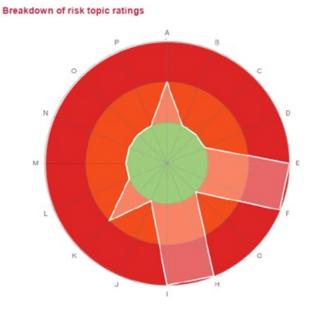
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## **Datasets and tools**

## **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.



Final project risk ratings

High Risk

A) Temperature increase B) Wild fire C) Permafrost D) Sea ice E) Precipitation increase F) Flood G) Snow loading H) Landslide I) Precipitation decrease J) Water availability K) Wind speed increase L) Onshore Category 1 storms M) Offshore Category 1 storms N) Wind speed decrease O) Sea level rise P) Solar radiation change

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### 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)						

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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/

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### 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'.

1. Identification of Climate INITIATE Threats and Opportunities 2. Assessment of Climate Risk and Vulnerability ASSESS 3. Identification of Climate Risk Management Options IDENTIFY 4. Assessment of Climate Risk Management Options PRIORITISE 5. Implementation of Climate Risk **Management Options** EXECUTE 6. Monitoring and Evaluation of **Climate Risk Management** REVIEW

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## **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

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# **Examples of good practice**

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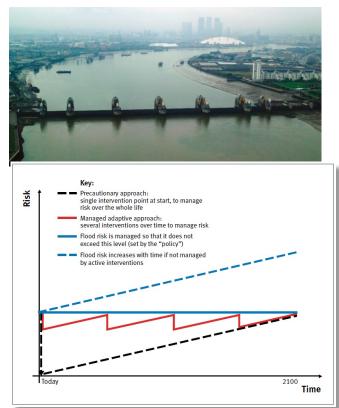
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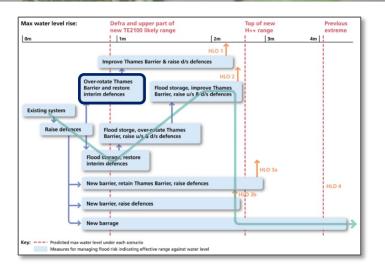
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# Simple adaptation pathway: Thames Estuary 2100 project









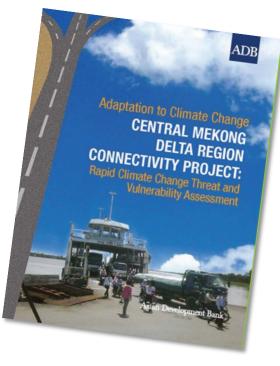
Managing flood risk through the century using the TE2100 managed adaptive approach allows changes in expected conditions, as they occur, to be addressed

## Roads resilience in Vietnam

## 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.



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# 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.



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Approaches

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### 

# 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-

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

- 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



### Establishes development context and focus

Identifies:

- Priority development goals and key inputs to achieving them
- Climate and non-climate stressors
- Needs and opportunities



### Enhances understanding about vulnerability

- · Defines vulnerability assessment questions
- Selects methods
- Assesses vulnerability
- · Provides actionable information



### Identifies, evaluates, and selects adaptation options

- · Identifies adaptation options
- · Selects evaluation criteria
- · Evaluates adaptation options
- Selects an adaptation option or portfolio of options



### Puts adaptation into practice

- Builds on established implementation and management practices
- Adopts a flexible approach to account for continuing change
- · Incorporates climate information into baseline values and indicators



### Tracks performance and impact

- Builds on established evaluation practices
- Measures performance
- · Evaluates impacts of actions on vulnerability
- Informs adjustments to adaptation strategies

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# Climate ADAPT Urban Adaptation Support Tool

Application: Development of municipal adaptation and resilience plans.

A process to help:

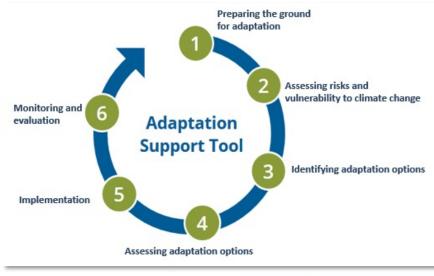
- Explore risks and vulnerability to current and future climate
- Identify and assess adaptation options
- Develop and implement a climate change adaptation strategy and/or action plan
- Monitor results

Success factors include:

- Strong leadership and mandate
- Collaboration: across departments and sectors and between service providers and users

Seurces The Union Adaptation Support Tool. Availableshitps://climate-adapt.cea.europalearknowledgefcols/urban-a

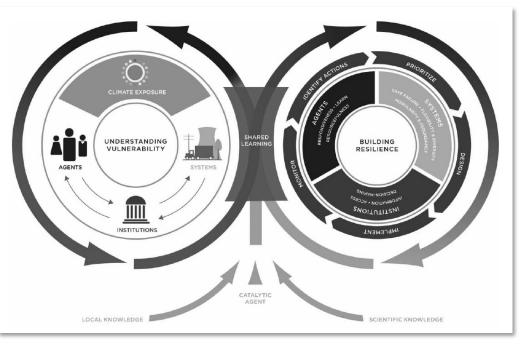
· Learning from the experience of others



 ✓ Standard tool adopted by signatories of the Covenant of Mayors



# **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

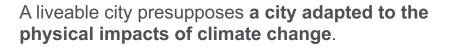
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and Muench, 2012. A framework for urban climate resilience. Climate and development 4: 311-

TOOLS:

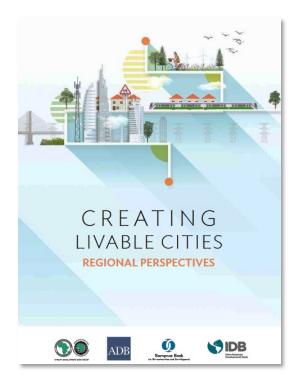
https://www.resilienceshift.org/tools

# ADB Creating Liveable Cities: Regional Perspectives



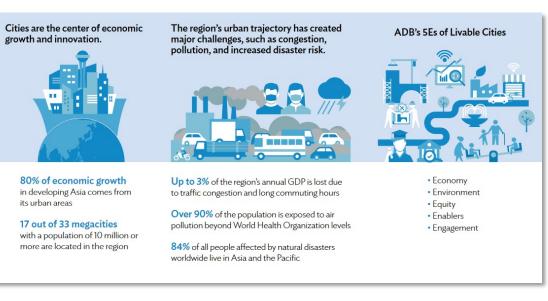
Climate change mitigation and adaptation are subcomponents of one of the '**5Es of Liveable Cities**'-Environmental Sustainability and Resilience.

- 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



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# 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.

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## 4. Current Policies and Guidelines for Monrovia

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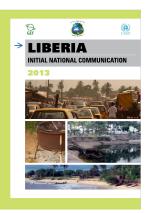
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# **Policy Context in Monrovia**



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 ESA UNCLASSIFIED - For Official Use



REPUBLIC OF LIBERIA



National Policy and Response Strategy on Climate Change

August 2018



**Environment Protection Agency, 2018** 

)/2016 | Slide 49

# 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.

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# Any Questions?

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