

→ EARTH OBSERVATION FOR SUSTAINABLE DEVELOPMENT

Climate Resilience

Capacity Building for Kyrgyzstan

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Webinar 01: 8 June 2021

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.

- 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 Kyrgyzstan**

Prolonged precipitation deficits cause declines in water availability, resulting in low wheat yield

Springs-summer drought in 2007, 2008, 2010, 2011, and 2014 led resulted in soil moisture deficits in growing regions and low snow accumulation at higher elevations. This reduced water availability throughout the growing cycle, resulting in lower, poorer quality wheat yields and increases in commodity prices.

Flooding inundates causes damage to rural settlements, fields, and pasture, and cuts rural connectivity

On May 25th 2021, flooding in Baika-ata district flooded 37 homes, cut the drinking water supply, and destroyed 70Ha cropland.

https://www.unescap.org/sites/default/files/11.%28Kyrgyz%29Key%20challenges%20and%20plans%20for%20drought%20monitoring%20and%20management%20in%20Kyrgyz%20Republic_Kanatbek%20Karybai%20Uulu.pdf
https://www.droughtmanagement.info/literature/FAO_Drought_characteristics_and_Management_in_CAsia_Turkey_2017.pdf
https://akipress.com/news:658659:Mudflow_flooded_dozens_of_backyards,_field_in_Talas_region/

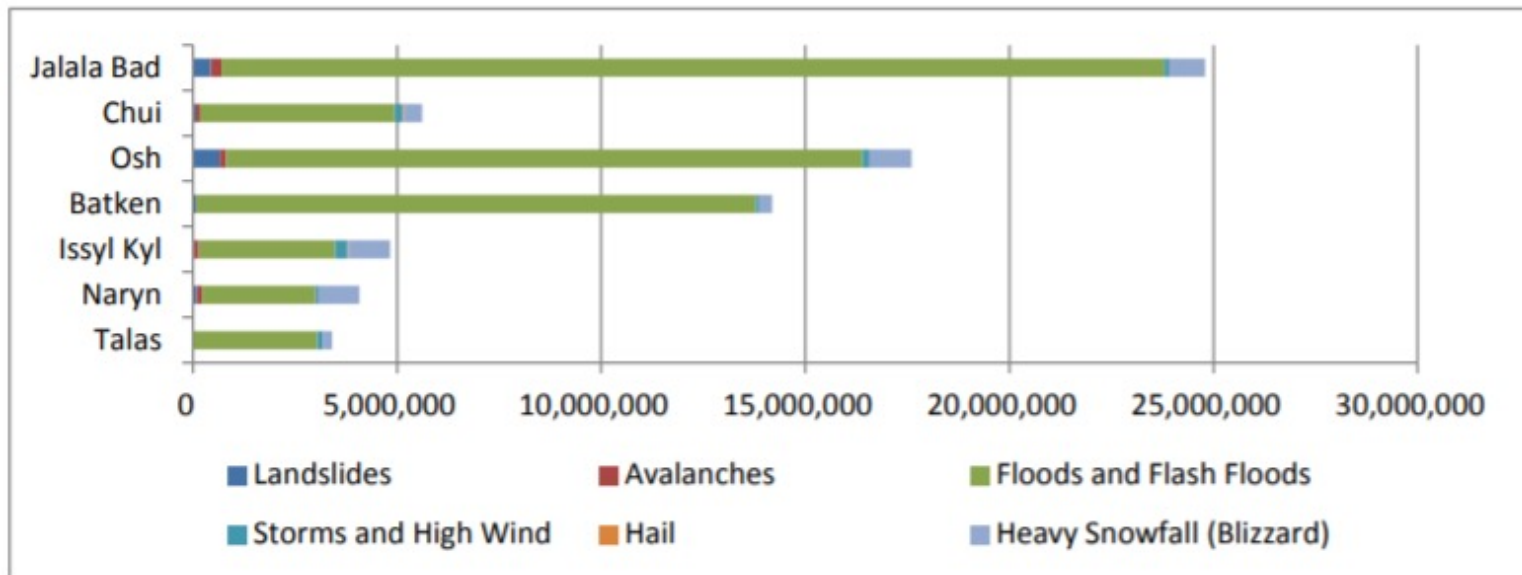


Fluvial flooding and mudflows regularly destroy already-vulnerable bridges, cutting off communities from pasturelands.

Drought is a natural phenomenon in Central Asia, however drought events are projected to become more severe, undermining livelihood security.



**Total estimated damages from climate-related events between 2000 – 2011
in USD (adjusted for inflation), by oblast and peril.**



<https://cdkn.org/wp-content/uploads/2013/08/Kyrgyzstan-Climate-Risk-Profile-Report.pdf>

The average annual damage caused by climatic emergencies (including drought and water shortage) for the main agricultural crops in 1991-2011 in USD (in 2005)

Crop	Damage from all climatic emergencies in thous. \$2005	Damage attributable to drought and water deficit in \$2005	Percentage of damages attributable to drought and water deficit
Wheat	6560,26	5826,35	88,81
Barley	934,68	728,46	77,94
Rice	237,82	182,96	76,95
Corn	996,04	820,10	82,34
Pulses	28,16	26,68	94,74
Oats	2,68	2,07	77,24
Tobacco	251,66	202,54	80,48
Sugar beet	2216,86	2066,22	93,20
Oil-plant	202,36	165,50	81,78
Potato	249,57	143,40	57,46
Vegetables	2358,09	1817,60	77,08

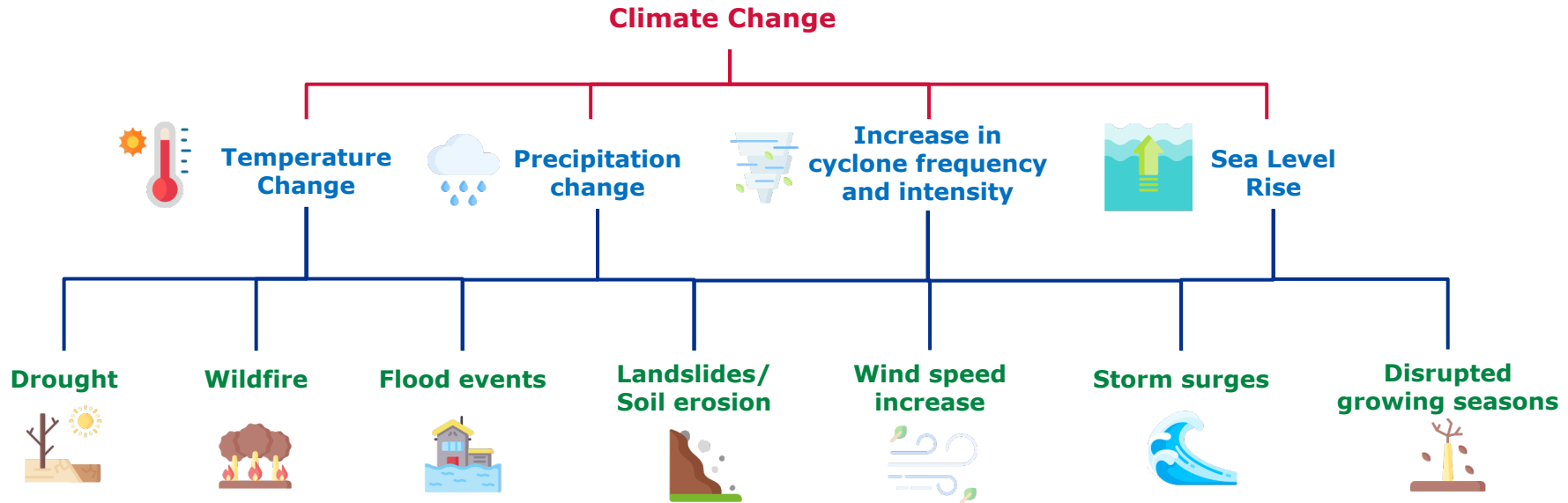
https://unfccc.int/sites/default/files/resource/NC3_Kyrgyzstan_English_24Jan2017.pdf

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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.



Cascade of effects

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



2. Key climate risk concepts

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):

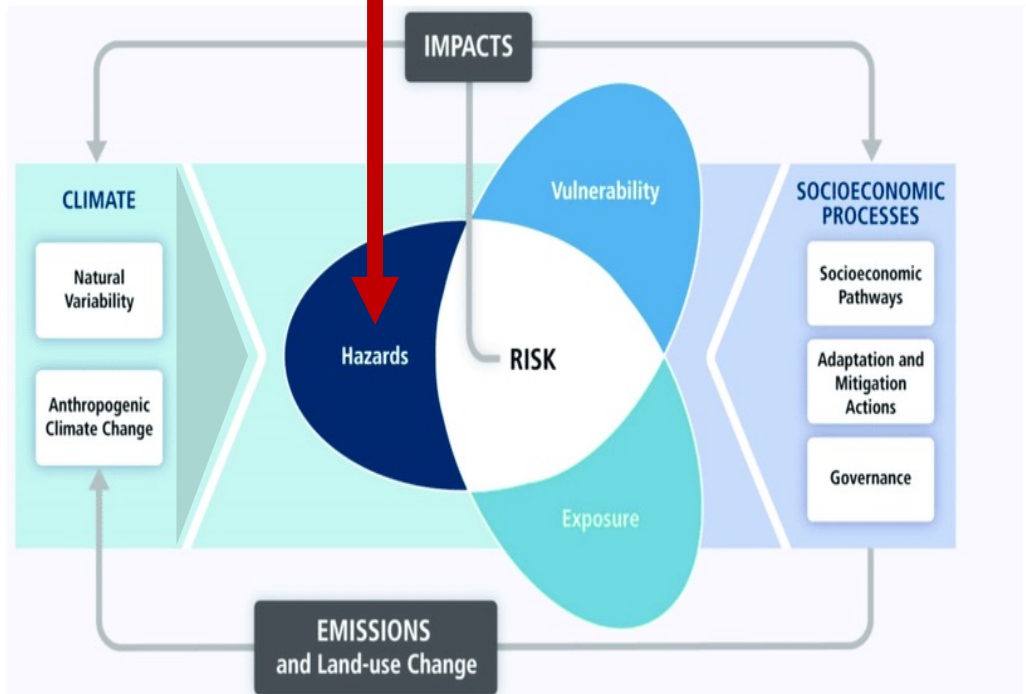
*"...results from the interaction of **vulnerability** (of the affected system), its **exposure** over time (to the hazard), as well as the (climate-related) **hazard** and the likelihood of its occurrence."*

Risk = Probability X Consequence

$$\text{Risk} = \text{Probability} \times \text{Consequence}$$

Hazard

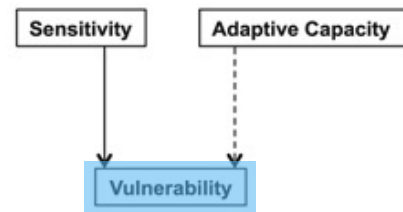
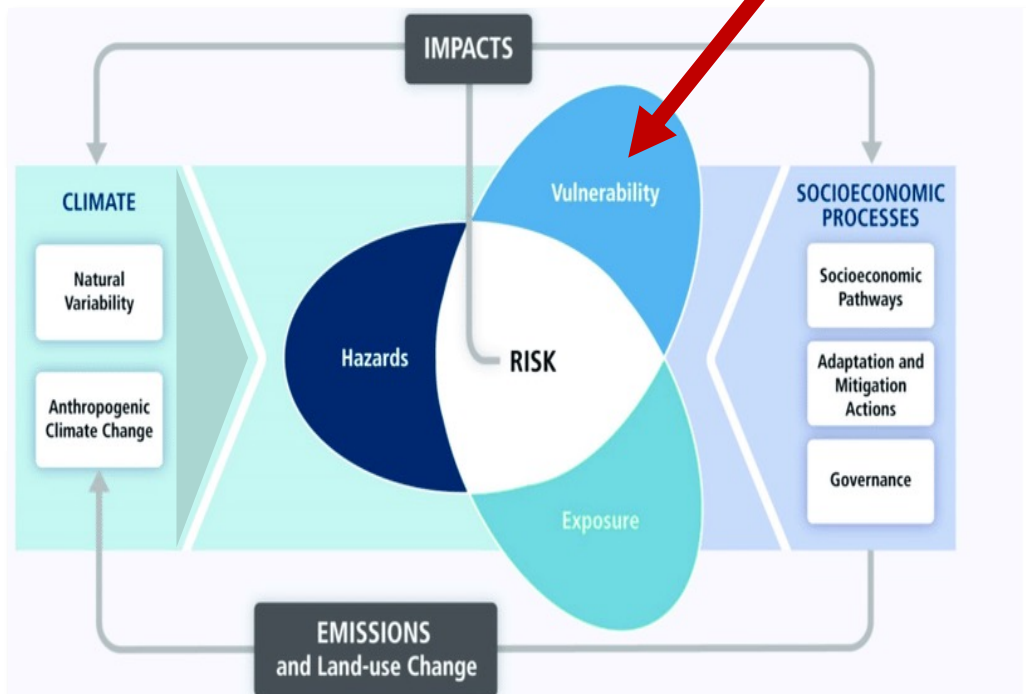
“Climate-related **physical events or trends** or their physical impacts.”



$$\text{Risk} = \text{Probability} \times \text{Consequence}$$

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

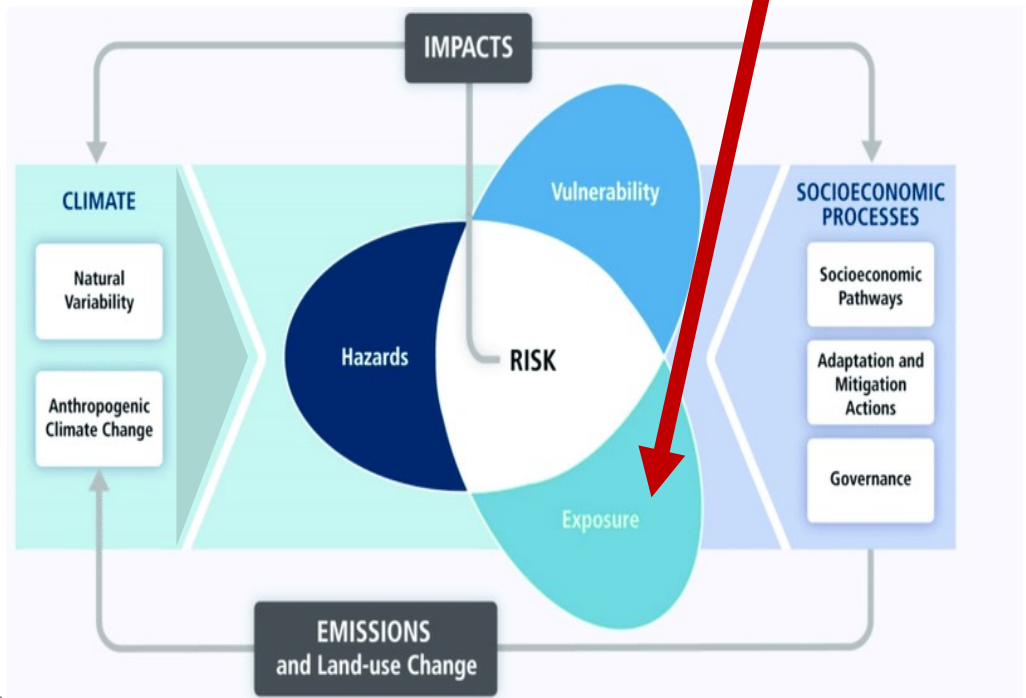
Adaptive capacity

How much you can change to change

$$\text{Risk} = \text{Probability} \times \text{Consequence}$$

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."



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



> Households (no.)

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)

➤ **Livestock dependency (% households where livestock provides main source of income)**



Photo by [Patrick Schneider](#) on [Unsplash](#)

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 allreza nasiri on Unsplash



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)

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Photo by alireza naseiri on Unsplash



Hazards and their associated impacts can be divided into be:

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

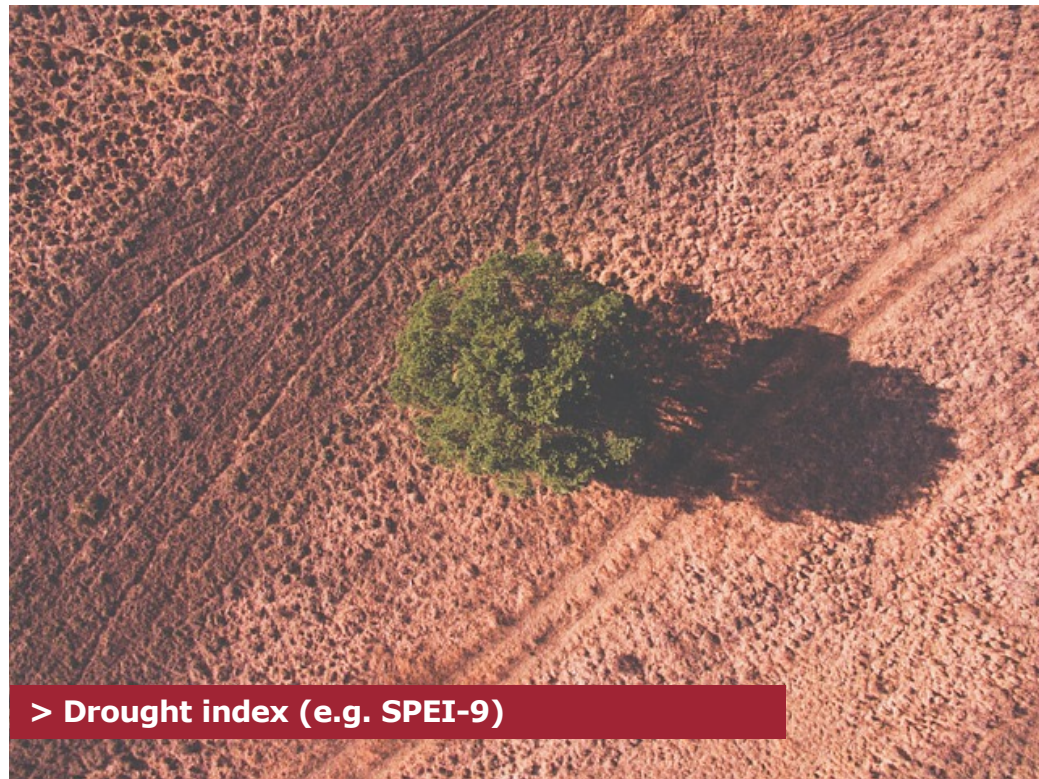
Example indicators

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

- **Extreme / episodic** –

Example indicators

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

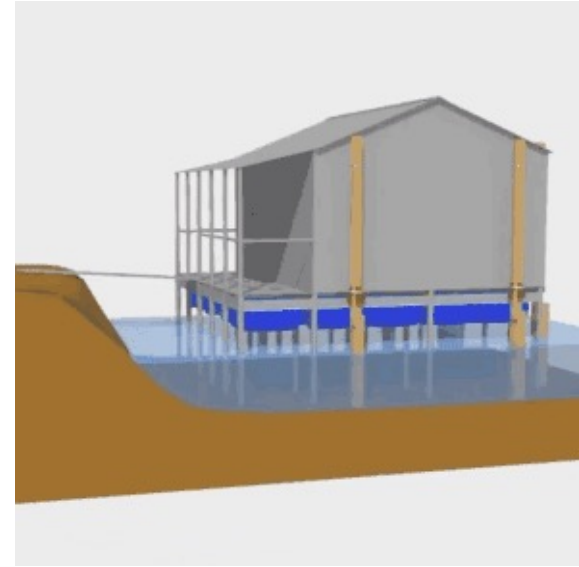


The IPCC's Fifth Assessment Report defines **resilience** as:

“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).



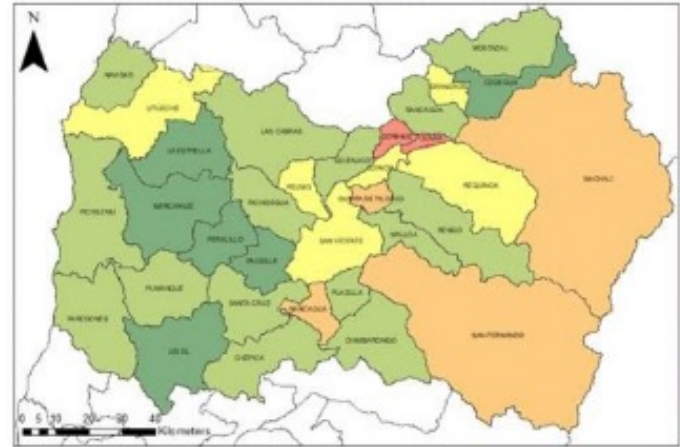
Climate change resilience processes are :

- 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

- 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/Aclimatise, 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.

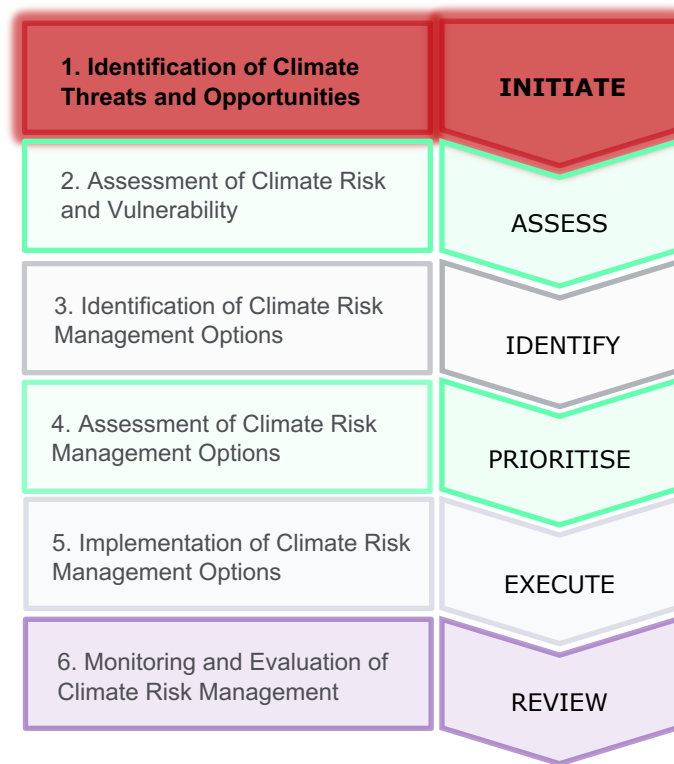


Identify Climate Threats and Opportunities

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

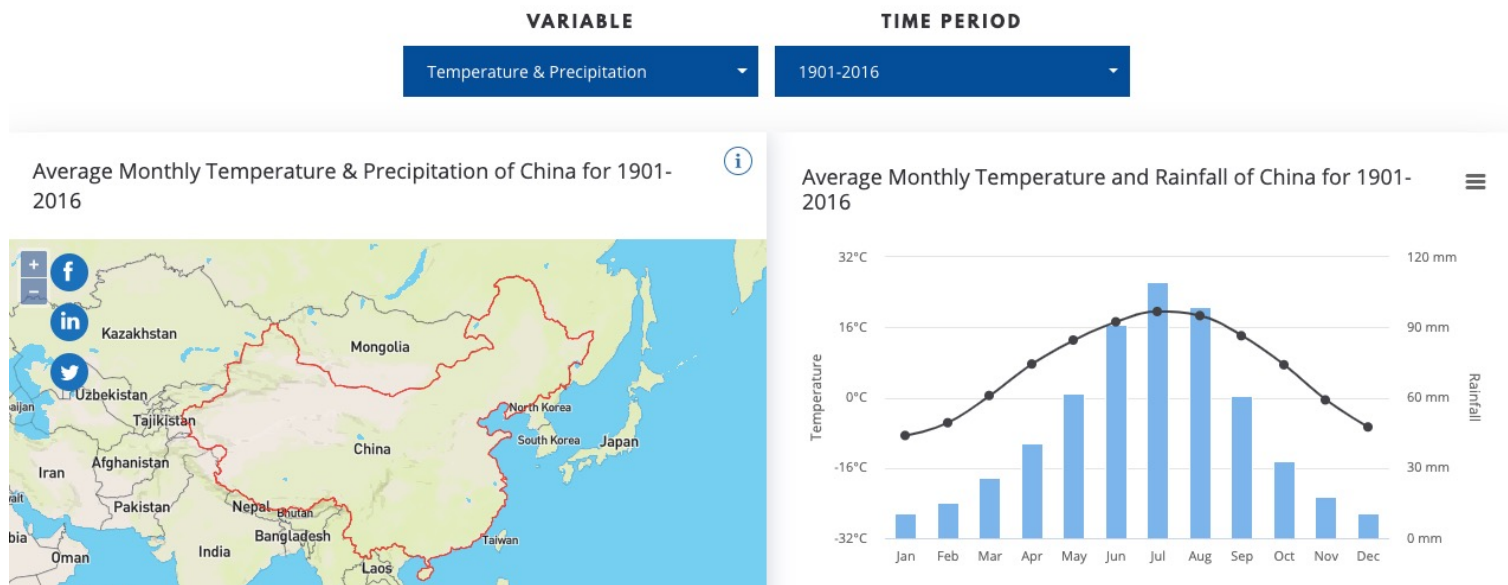
This involves:

- 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

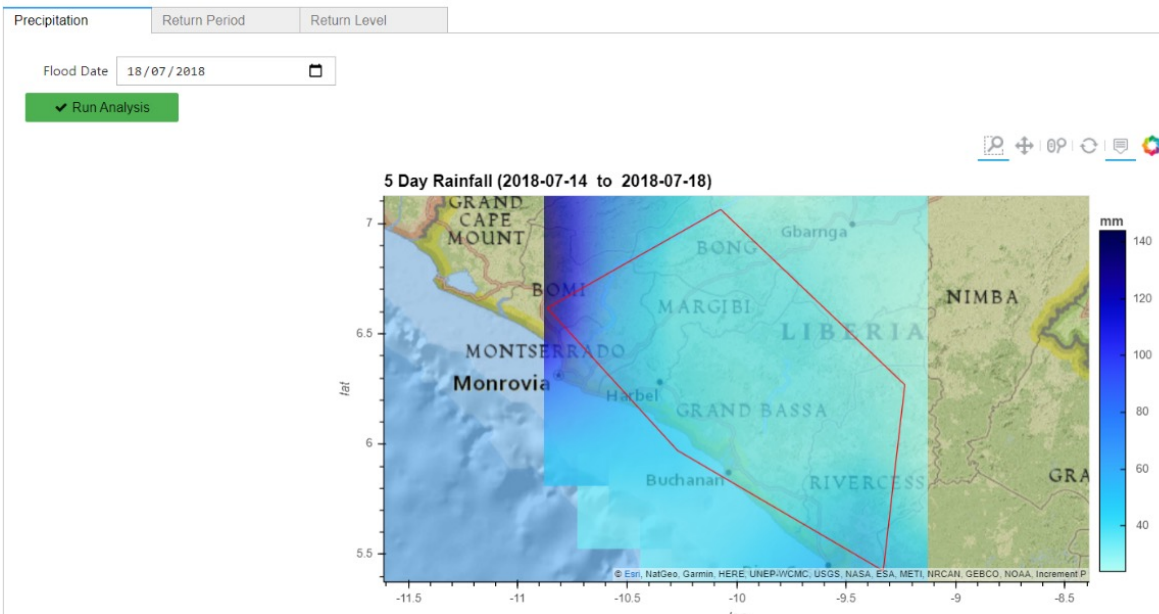


Datasets and tools

EO4SD Rainfall Explorer

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

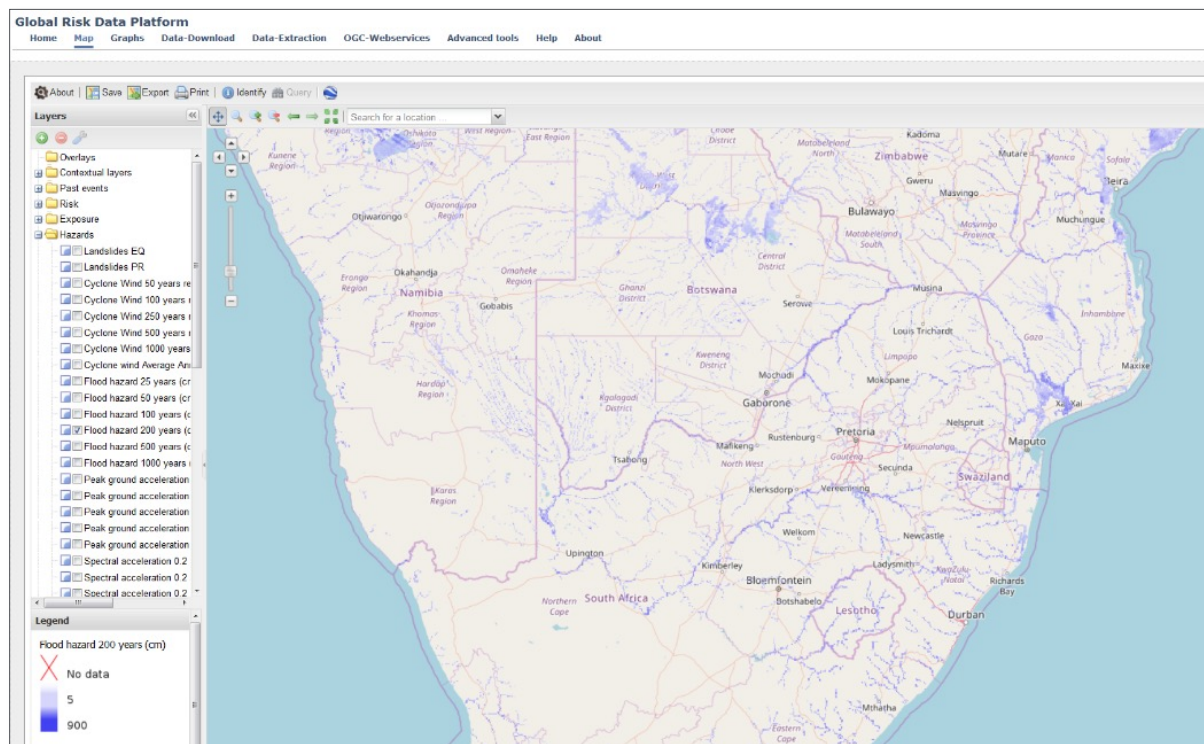
- Casualties: 0
- Displaced: 0
- Main Cause: Monsoonal Rain



Datasets and tools

Global Risk Data Platform

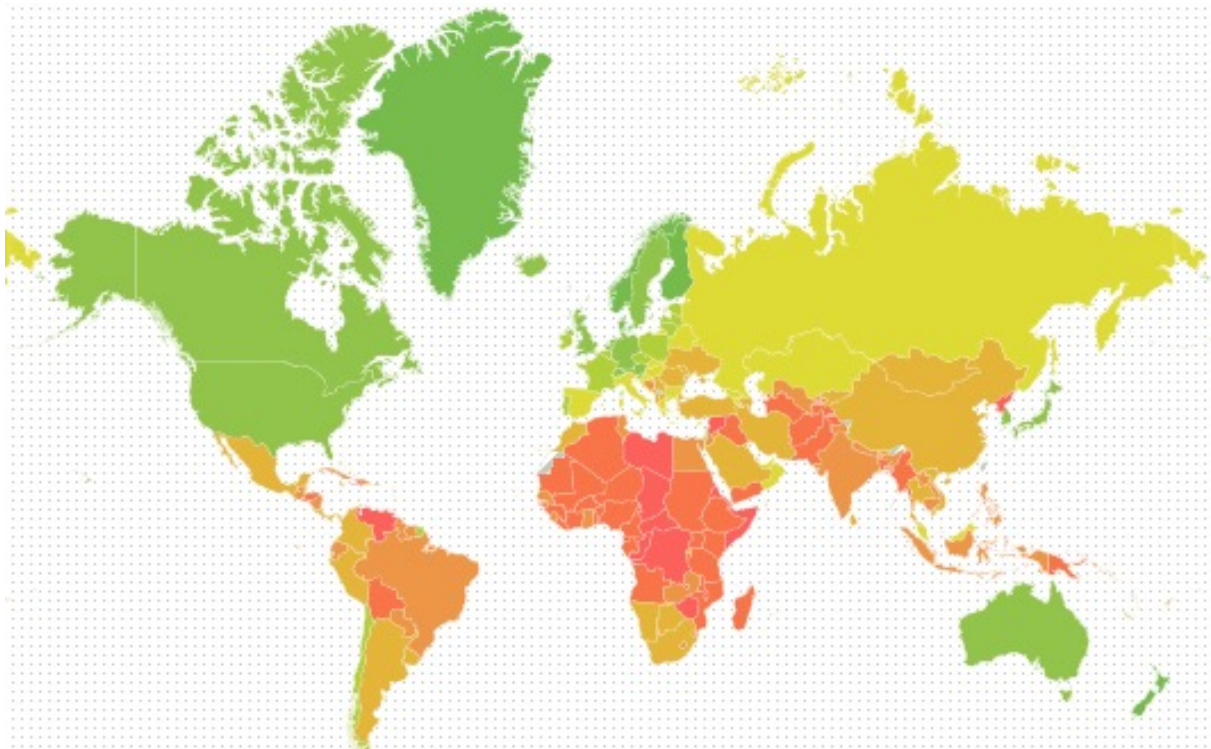
- Global natural hazard and risk data
- Baseline only
- Visualise, extract, and download data



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.



Datasets and tools

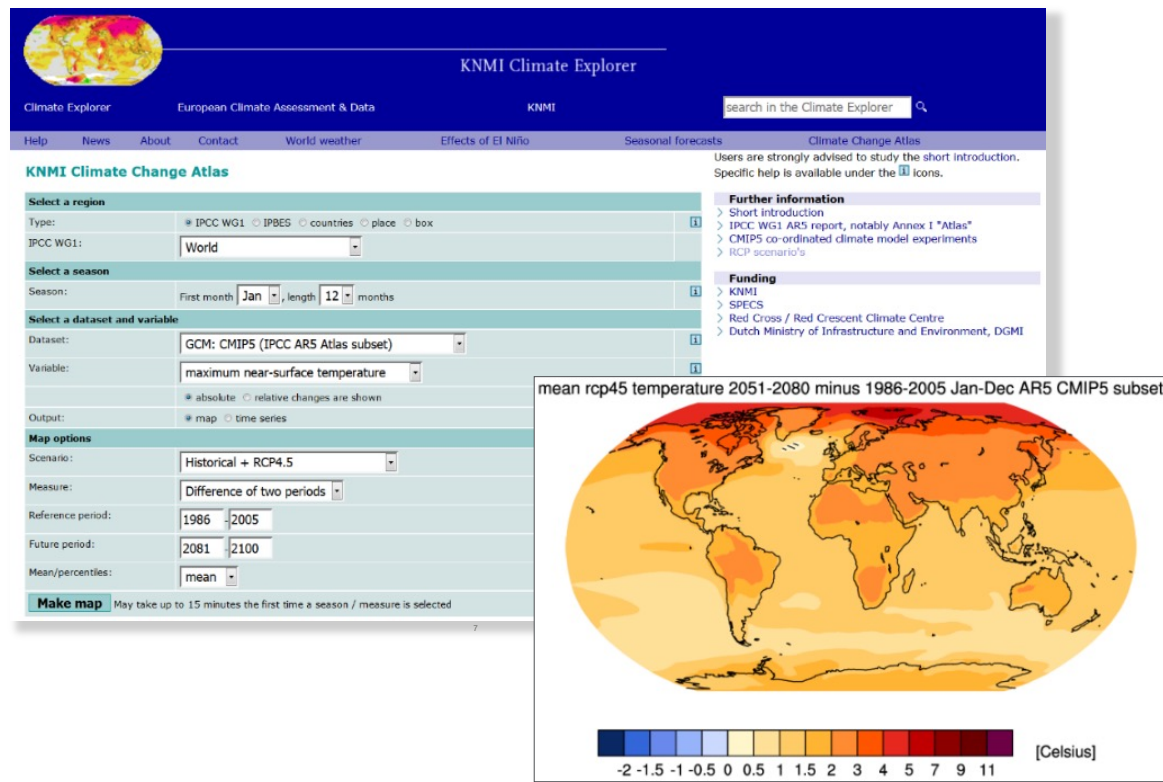
KNMI Climate Change Atlas

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

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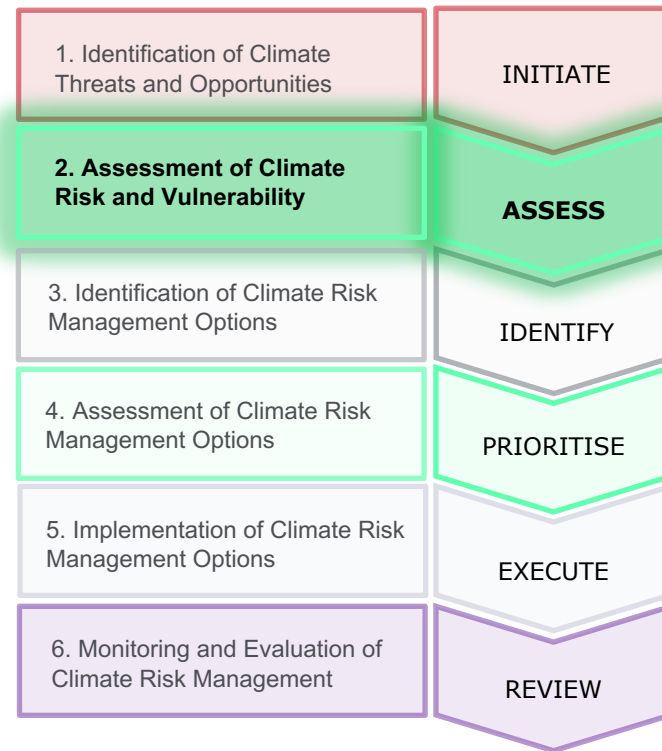
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Assess climate risk and vulnerability

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



A climate resilience process: Stage 2

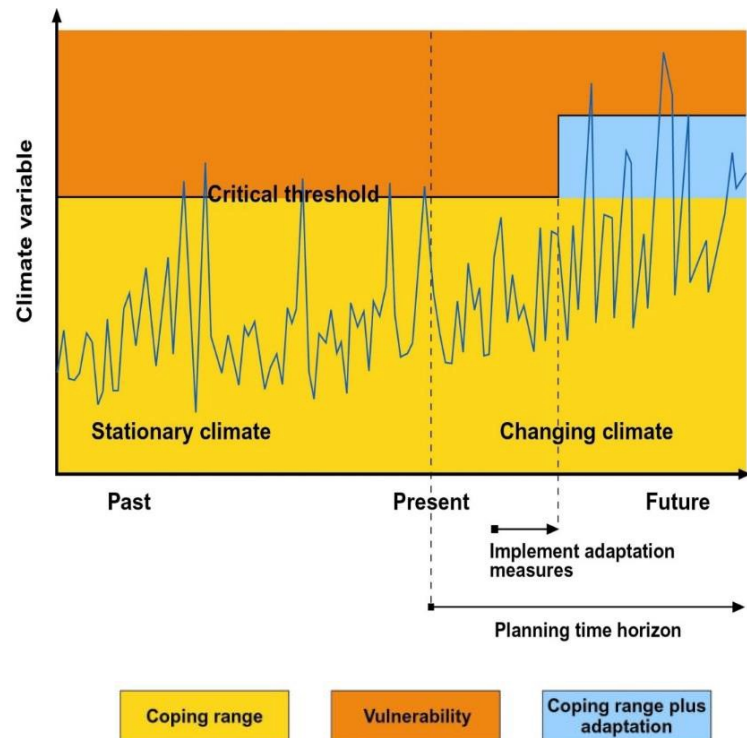
The performance of a wide range of assets can be affected by climate.

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?

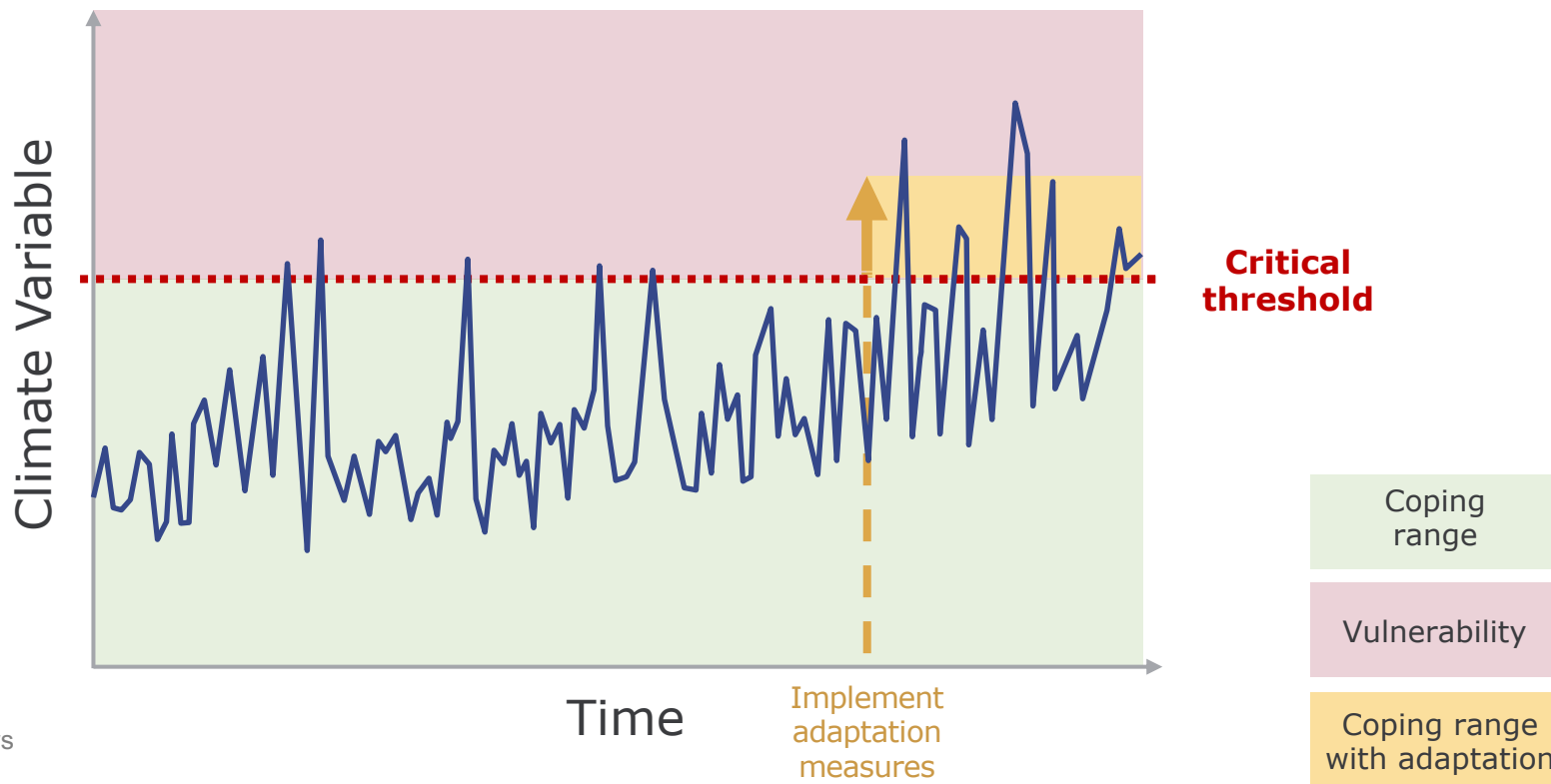
For example:

- 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

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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	<i>Increased insurance premiums</i>	<i>New market opportunities</i>
Premises	<i>Repeat flooding</i>	<i>Opportunity to relocate</i>



Photo by elias on Unsplash

Datasets and tools

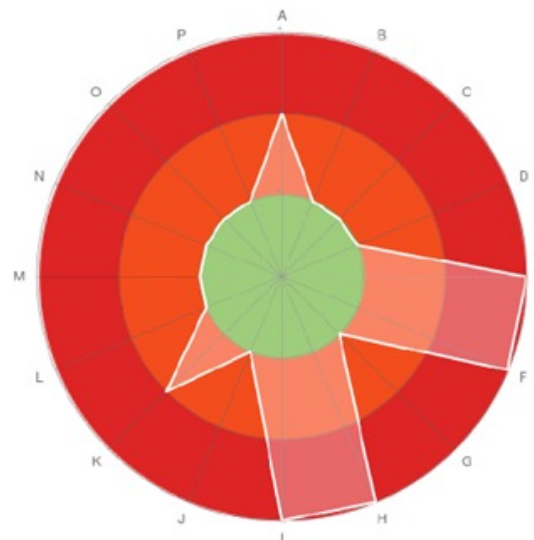
Aware™

- 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

Breakdown of risk topic ratings



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

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:

$$\text{Risk} = \text{Consequence} \times \text{Likelihood}$$

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

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/>

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'.



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

Forecasting agricultural output using Space, Agro-meteorology and Land based observations (FASAL)

Beyond FASAL SAC is involved in National Food Security Mission (NFSM of DAC) – initiations such as Bringing Green Revolution to Eastern India (Monitoring the impact on rice production), Forecasting disease and damage desection (Yellow rust in wheat), Pulse crop intensification assessment and Techniques Development for Prototype for crop insurance.

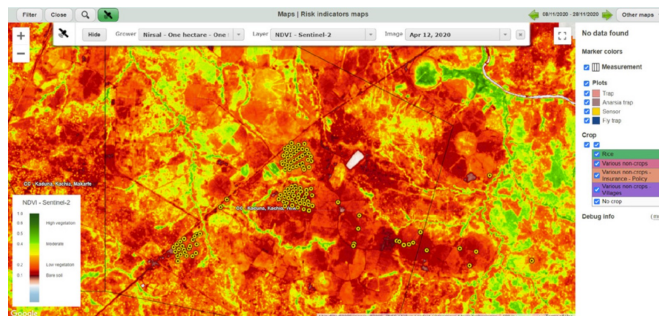


<https://www.sac.gov.in/Vyom/Agriculture.jsp>

Royal Exchange and Agritask - Nigeria

Since 2019, Agritask has worked with Royal Exchange to provide an agri-insurance platform that delivers relevant climate data in real-time.

Clients can check the details of their cover, purchase new products, receive alerts and information. This includes notification of when **climate risk thresholds have been breached** and if they are eligible for a payout. It also provides farmers with valuable information about climate and weather events that they can then use to inform and improve their farming practices, helping them to adapt and become more resilient to changing conditions.



Screenshot from Agritask's agri-insurance platform showing vegetation cover over Kachia, Nigeria



Insurance Resilience
Blue Orchard
CelsiusPro
BMZ
KfW

“Users can see, in real-time, farm data location and the weather conditions including temperature, and levels of precipitation”

Chukwuma Kalu, Head of Agric Insurance & Emerging Business at Royal Exchange

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



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

Climate ADAPT Urban Adaptation Support Tool



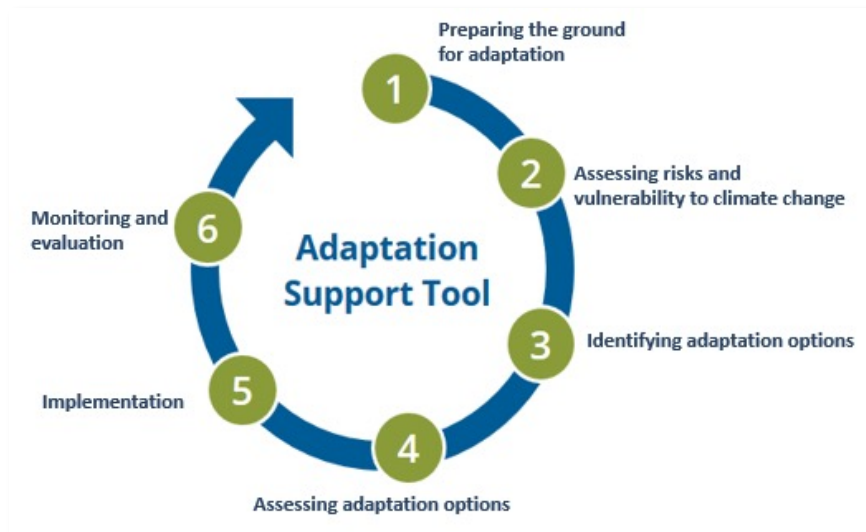
Application: Development of municipal adaptation and resilience plans.

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:

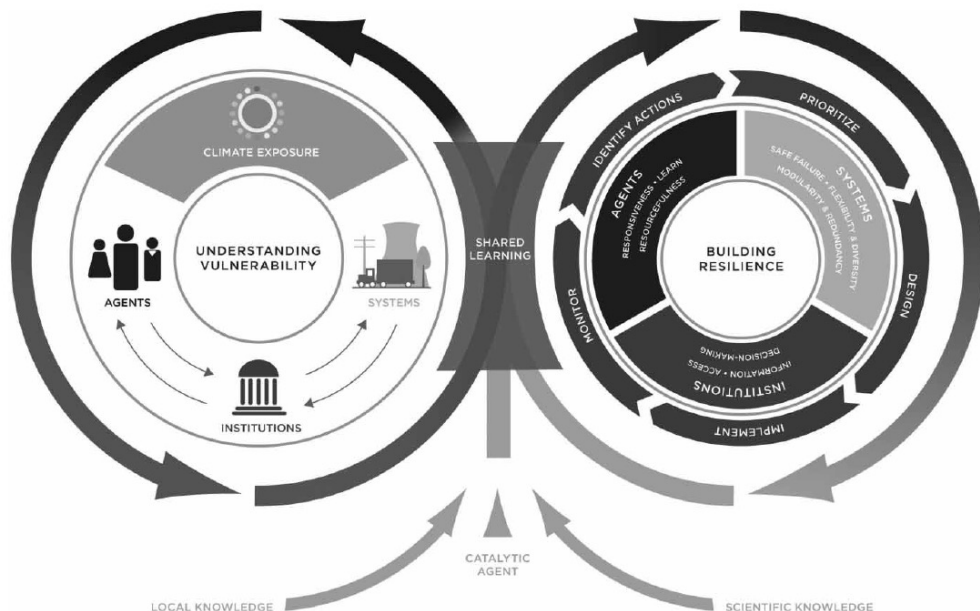
- Strong leadership and mandate
- Collaboration: across departments and sectors and between service providers and users
- Learning from the experience of others



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



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.

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.

**Presentation then showed different policies relating to different project areas. These can be found fairly easily by searching online for Kyrgystan's National Adaptation Plan, and other policy areas.*

- 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.

- What does a climate-resilient Kyrgyzstan look like?
- What actions can individuals, communities, and existing institutions take to build resilience?
- What alliances need to be built in order to build resilience long-term?