ADAPTATION TO CLIMATE CHANGE

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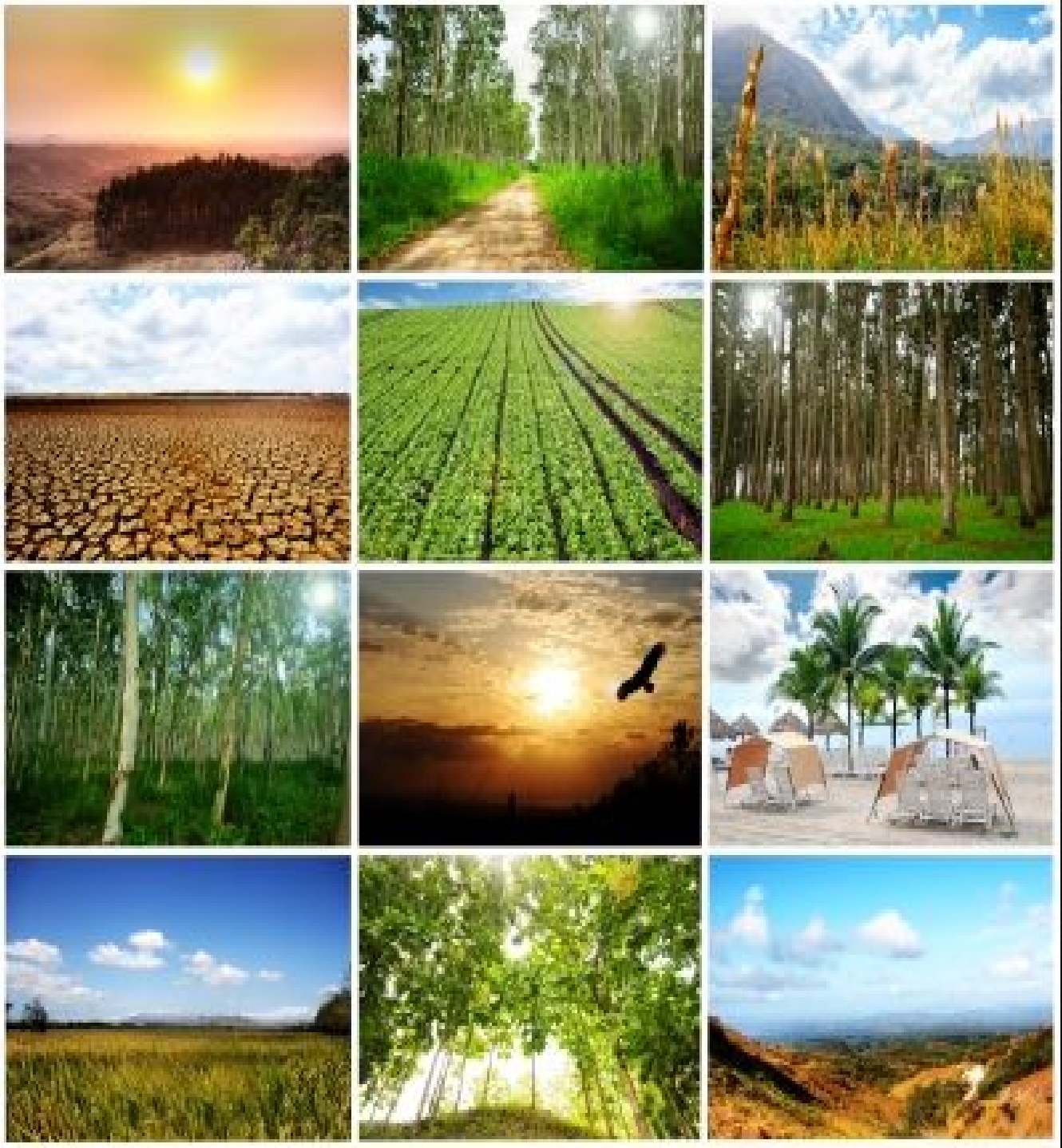


AGENDA

- How should we understand adaptation to climate change?
- Types of adaptation needs as the core of adaptation process
- Adaptation options
- Assessing and measuring adaptation + maladaptation
- Implementation of adaptation
- Adaptation opportunities, constraints and limits
- Economics of adaptation

Climate change and Adaptation

Adaptation: The process of change and adjustment to better suit certain conditions

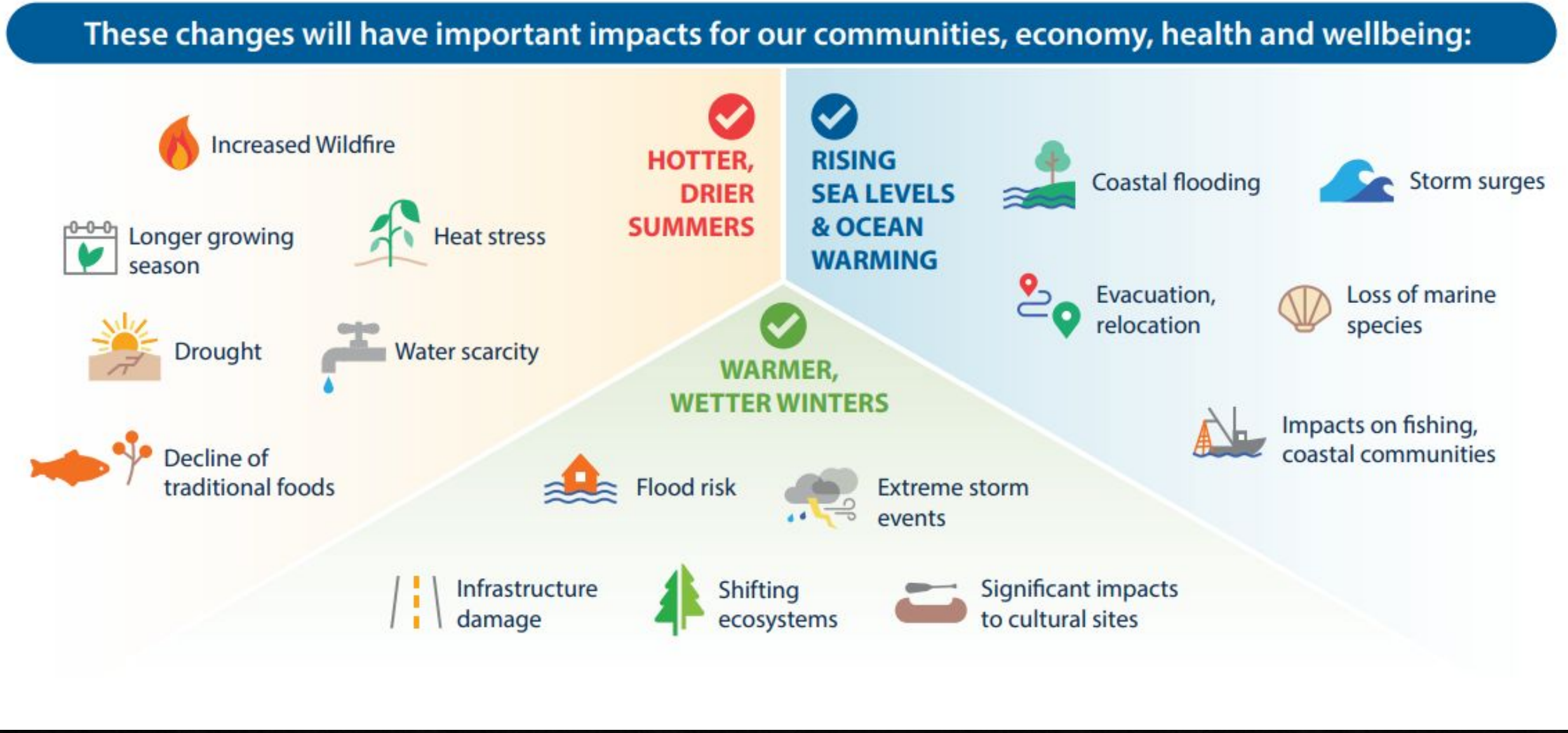
Adaptation to Climate Change: The process of adjustment to actual or expected climate and the effects the change may bring

Adaptation to climate change

- Adaptation and mitigation are closely linked; adaptation efforts will be more difficult, more costly, and less likely to succeed if significant mitigation actions are not taken.

- Preparing for climate change strengthens our ability to respond to extreme events like wildfires, flooding and heatwaves, as well as more gradual changes like water shortages and sea level rise.

conditions we are adapting to



Importance of Adaptation

We can’t undo the past and avoid the effects of climate change, but we can be better prepared to adapt and reduce the impacts.

- Adaptation strengthen the resilience of our communities, ecosystems and economy.
- Lower long-term costs
- Often result in social and environmental benefit for current utilization

Adaptation types

Incremental adaptation - actions where the central aim is to maintain the essence of the existing technological, institutional, and systems

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Transformational adaptation seeks to change the fundamental attributes of systems in response to actual or expected climate and its effects, often at a scale greater than incremental activities.

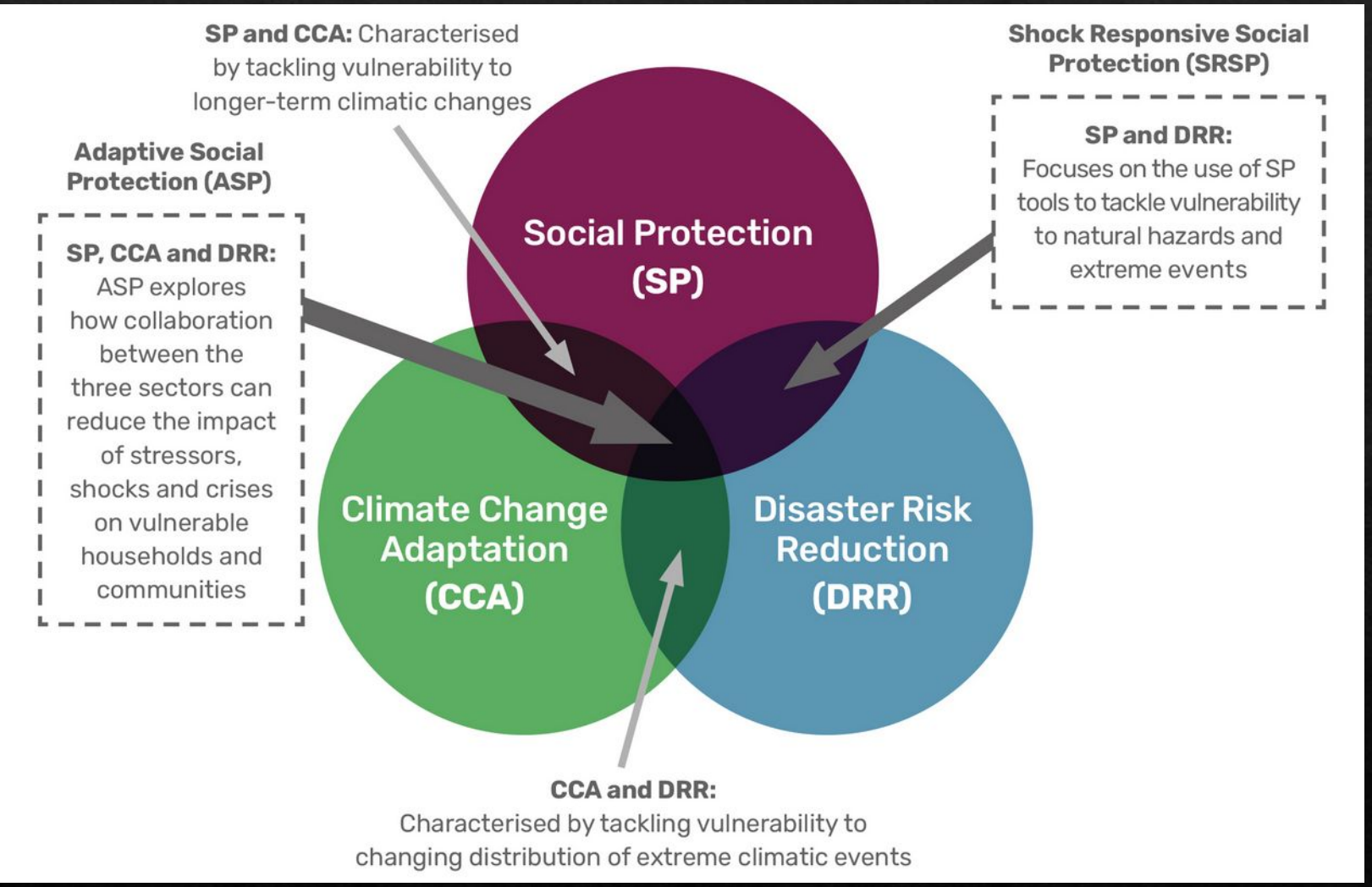
Adaptation Needs

- Adaptation needs are the gap between what might happen as the climate changes and what we would desire to happen; between current outcomes and desired outcomes

- In order to identify adaptation needs, adequate information on risks and vulnerabilities is essential.

- Adaptation needs are highly diverse, dynamic and context specific

Approaches to Adaptation Needs



- The risk-hazard framework, drawn primarily from risk and disaster management, focuses on the adverse effects of natural hazards on the physical and biological aspects of a location

- The social vulnerability framework focuses on the reasons and how different factors, such as institutions, shape the socioeconomic conditions that place human populations at risk

Types of Adaptation Needs

- Biophysical & Environmental Needs
- Social Needs
- Institutional Needs
- Need for engagement of the private sector
- Information, Capacity and Resources needs

Types of Adaptation Needs

Biophysical & Environmental Needs

- Climate change induces shifts in habitats, leading to changed ecosystems, to local and global extinctions.
- The need is to protect climate regulation services (Ocean systems, Green spaces, coral reefs) systems and resources within the changing climate that underpin human livelihoods and health

Types of Adaptation Needs

Social Needs

- Social needs include the range of needs for human security, which include elements necessary to people to act on behalf of their interests.
- key factors determining vulnerability are gender, age, health, social status, ethnicity, and class
- Social needs under climate change include understanding emotional and psychological needs.

Types of Adaptation Needs

Institutional Needs

- Governments reduce the risk and enhance the adaptive capacity of vulnerable areas by developing and implementing locally appropriate regulations.
- local scale institutions is pivotal when adapting to extreme weather events

Types of Adaptation Needs

Need for engagement of the private sector

- Private sector can become involved in adaptation through:
  - Internal risk management, to protect their own interests
  - Acting as a stakeholder
  - Identifying new opportunities in the business community.

Types of Adaptation Needs

Information, Capacity and Resources needs

- Availability of information, access to technology and funding is pivotal.
- Funding should benefits the poor, as they often are most vulnerable to climate-related disasters
- An important concern is that, too much emphasis might be placed on addressing climate change as an isolated priority to the detriment of other equally pressing social, economic, and environmental issues.

Adaptation Options

Understanding adaptation options

- **Adaptation options are aimed at:**
  - Accepting impacts and bearing the losses that result from risks
  - Offsetting losses by sharing or spreading risks
  - Avoiding or reducing exposure to climate risks
  - Exploiting new opportunities

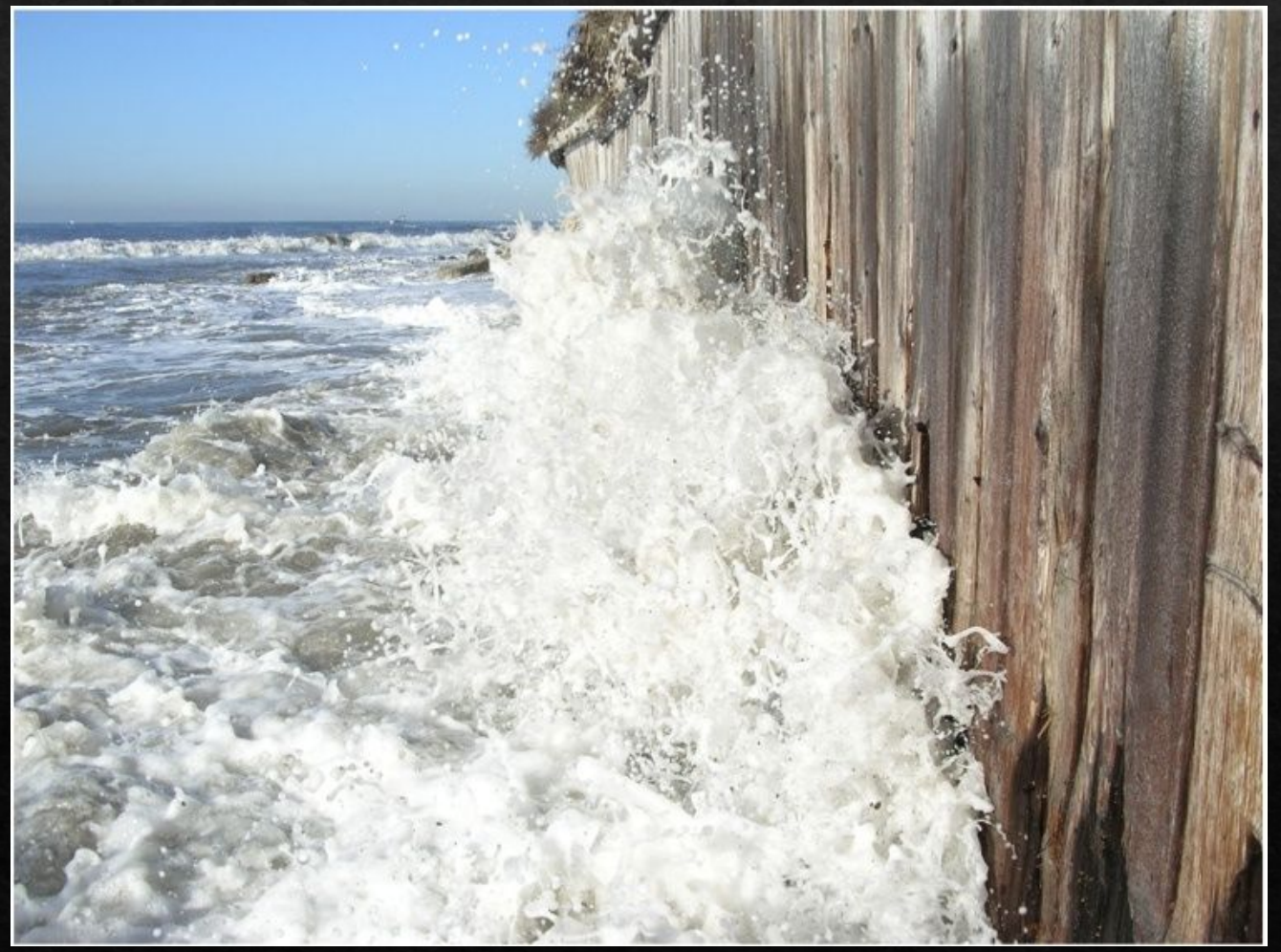
Adaptation Options Types

- **Structural and physical options** - clear outputs and outcomes, well defined in scope, space and time
- **Social options** - target specific vulnerability or disadvantage groups
- **Institutional options** - economic instruments (taxes, regulations, subsidies)

Structural and Physical options

- Subtypes:
  - **Engineered and built environment -** expert-driven, large scale, capital intensive
  - **Technological -** recent advances in technologies combined with engineering measures
  - **Ecosystem-based -** use of biodiversity and ecosystem services
  - **Services -** specific and measurable activities (public health, food svcs)

Engineered and built environment examples: seawalls

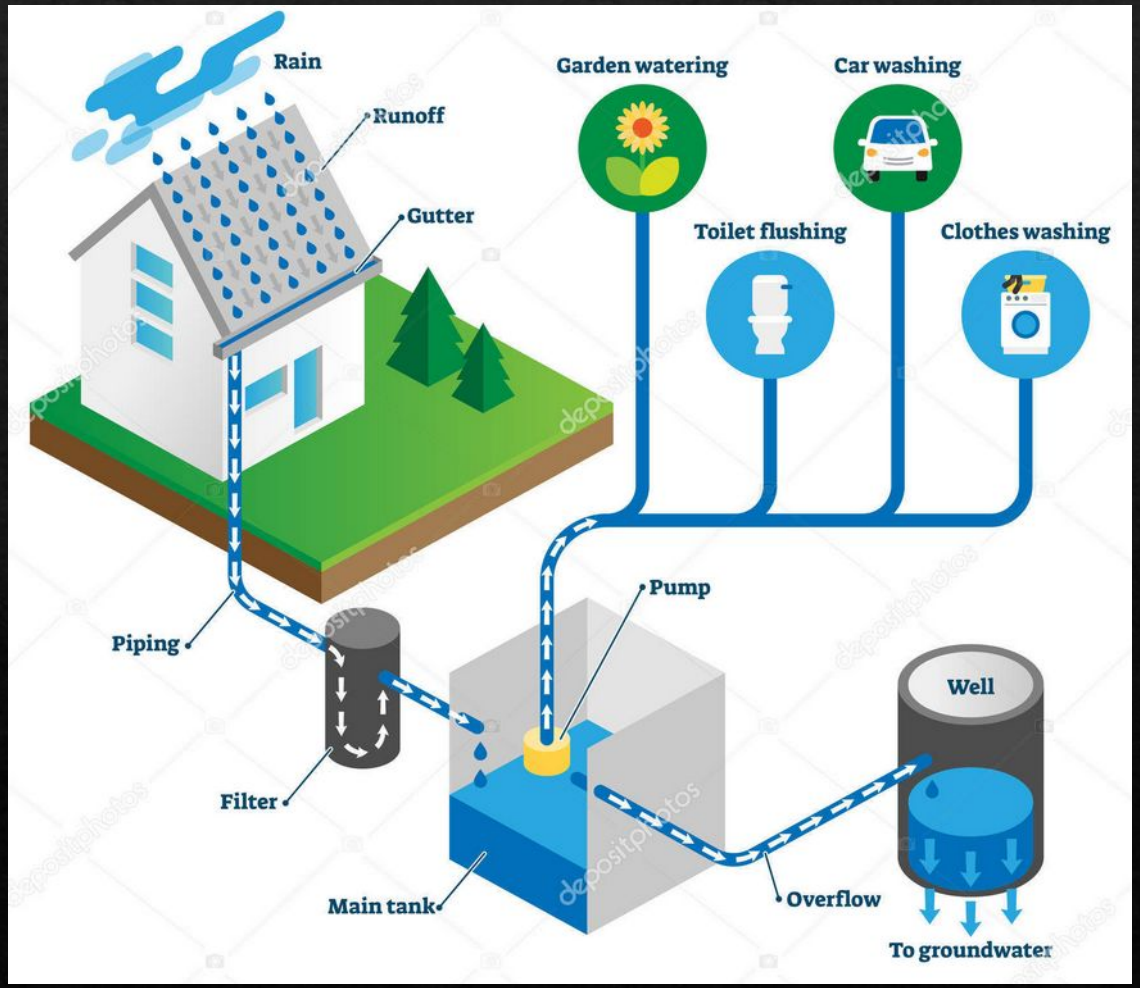


Engineered and built environment examples: sewage works

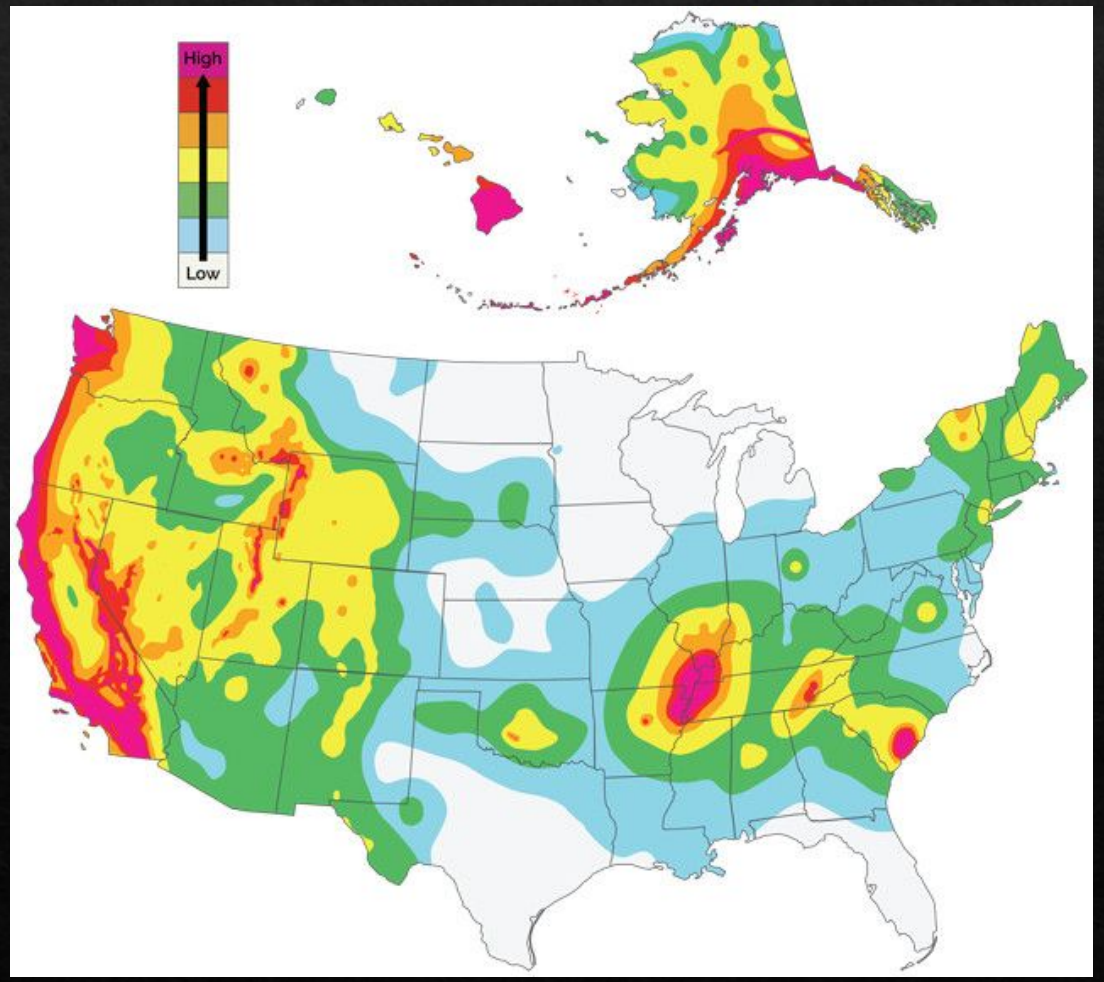
Engineered and built environment examples: flood and cyclone shelters

Technological examples: efficient irrigation

Technological examples: rainwater harvesting



Technological examples: hazard mapping and monitoring



Technological examples: renewable energy technologies

Ecosystem-based examples: afforestation and reforestation

Ecosystem-based examples: replanting mangroves

Ecosystem-based examples: green infrustructure

Services examples: social protection

Services examples: vaccination programs

Services examples: foodbanks

Social options

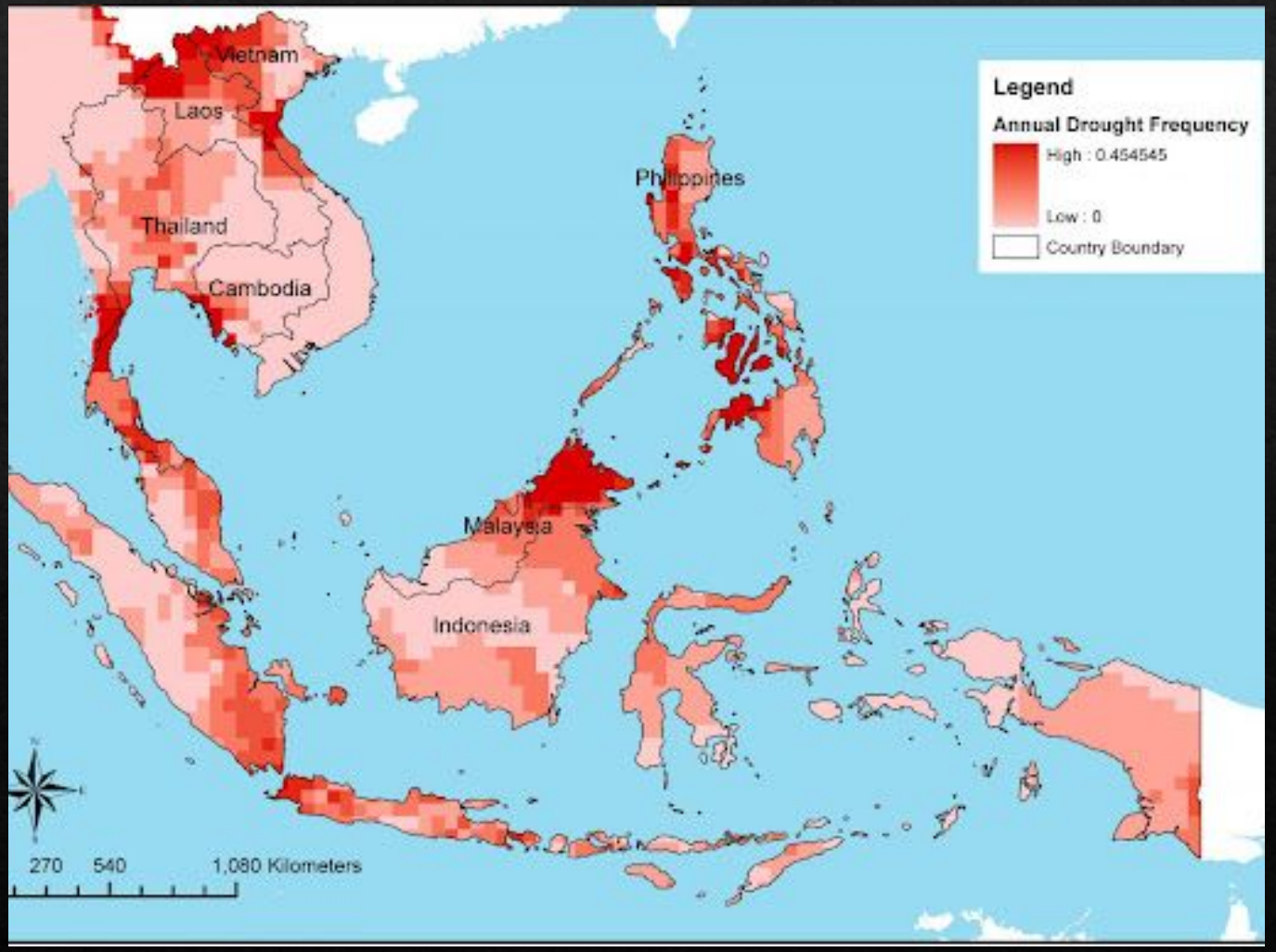
- Subtypes:
  - **Educational -** learning and knowledge sharing
  - **Informational -** early warning systems
  - **Behavioral -** directly influencing human behavioral patterns

Educational examples: awareness raising

Educational examples: gender equality in education

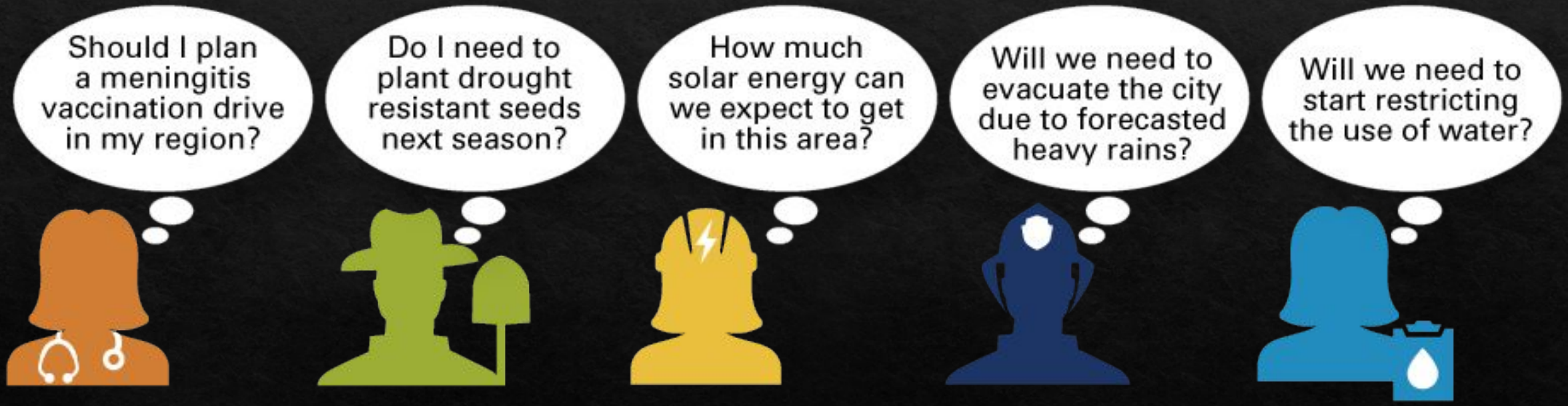
Educational examples: knowledge sharing

Informational examples: hazard and vulnerability mapping



Informational examples: community-based adaptation plans

Informational examples: climate services



Behavioral examples: household preparation and evacuation planning

Behavioral examples: soil and water conservation

Behavioral examples: changing livestock and aquaculture practices

Institutional options

- Subtypes:
  - **Economic instruments**
  - **Laws and regulations**
  - **Government policies and programs**

Economic examples: taxes and subsidies

Economic examples: insurance

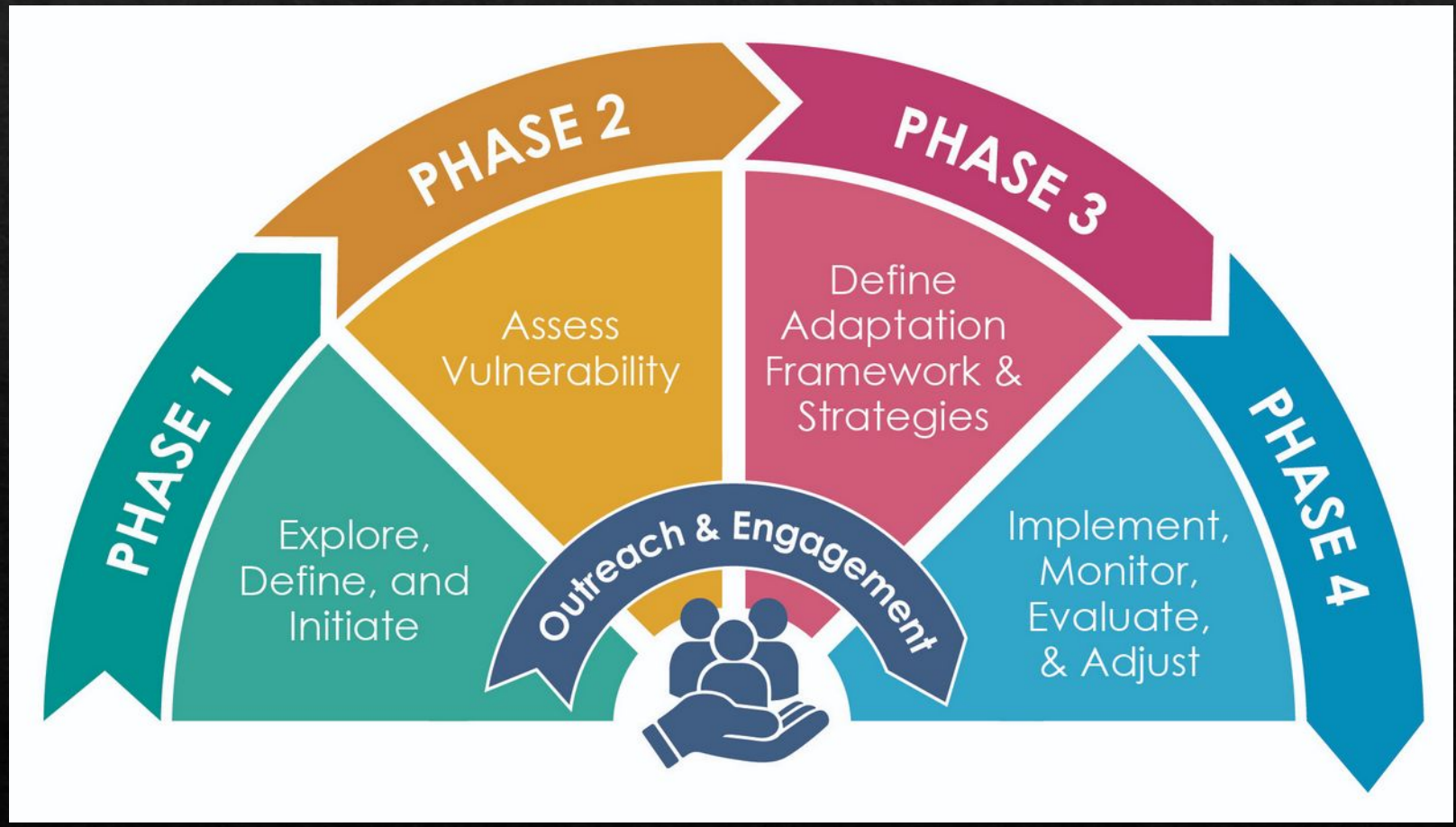
Economic examples: catastrophe bonds

Laws and regulations examples: building standards

Laws and regulations examples: water regulations

Laws and regulations examples: protected areas

Government policies and programs examples: national and regional adaptation plans



Government policies and programs examples: urban upgrading programs

Government policies and programs examples: sustainable forest management

Selection of adaptation options

- **Effective in reducing vulnerability and increasing resilience**
- **Efficient (increase benefits and reduce costs)**
- **Equitable, especially to vulnerable groups**
- **Designed for an appropriate scope and time frame**
- **Resources available (including information, finance, leadership, management capacity)**

Limitation of adaptation options

Main limits and constraints:

- **Not all adaptation needs will be met**
- **Not all adaptation options will be possible**

Adaptation Opportunities,

Constraints, and Limits

Definition of terms

- Adaptation Opportunities: Factors that make it easier to plan and implement adaptation actions, that expand adaptation options, or that provide ancillary co-benefits.

- Adaptation Constraints: Factors that make it harder to plan and implement adaptation actions.

- Adaptation Limit: The point at which an actor’s objectives or system’s needs cannot be secured from intolerable risks through adaptive actions.

Adaptation Opportunities

- Adaptation opportunities represent enabling factors that enhance the potential for actors to plan and implement actions to achieve their adaptation objective(s) or facilitate adaptive responses by natural systems to climate risk.

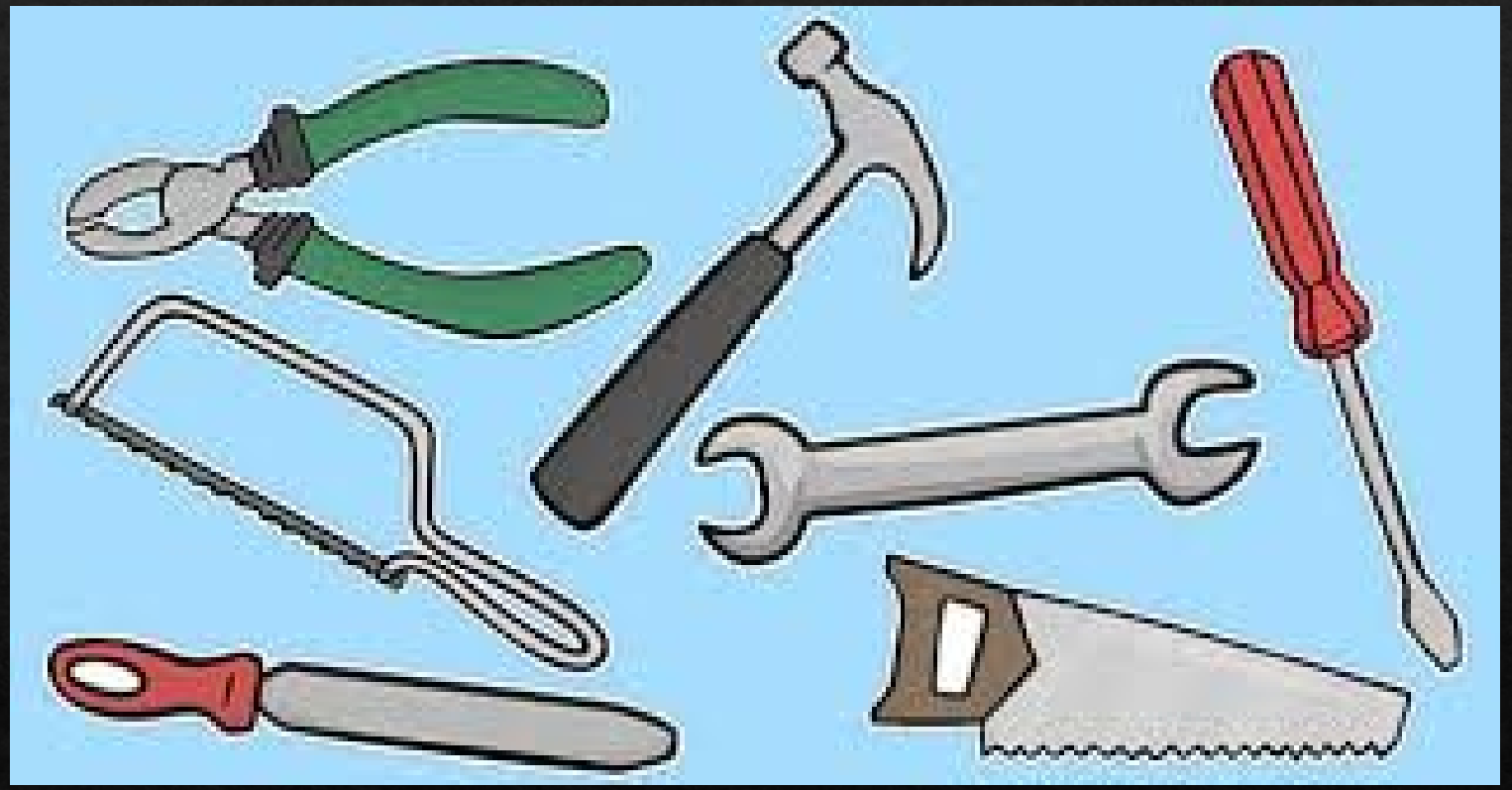
- Opportunities for adaptation range from increasing awareness of climate change, its consequences, and the potential costs and benefits of adaptation options to the implementation of specific policies that create conditions that are conducive to adaptation implementation.

  Examples…..

- Research, data, education and training
- Development of human capital

- Positive stake holders engagement
- Communicati on of risks and uncertainty

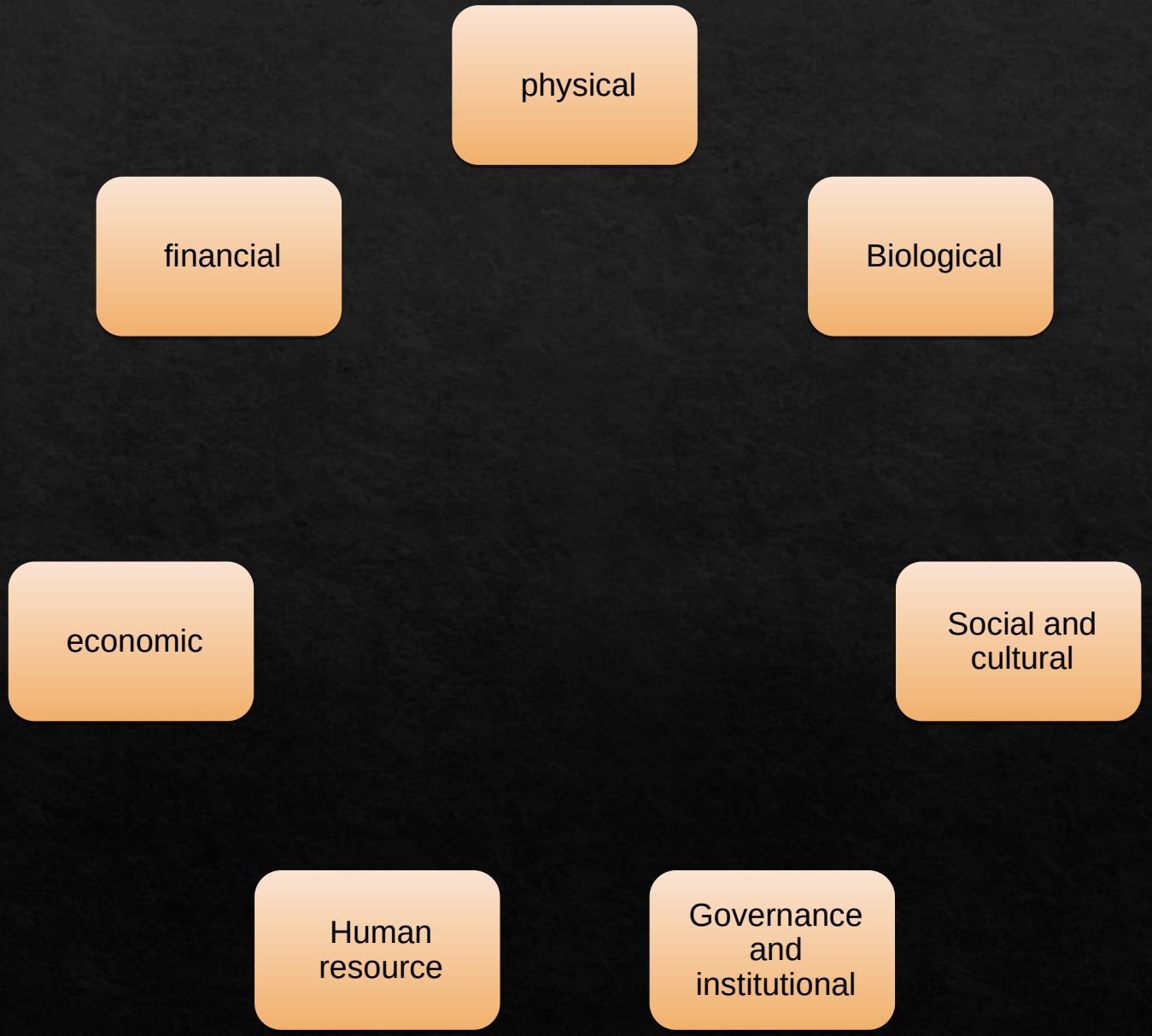
TOOLS



- Risk analysis
- Vulnerability assessments
- Cost benefit analysis

- Integrated resource and infrastructure planning
- Spatial planning

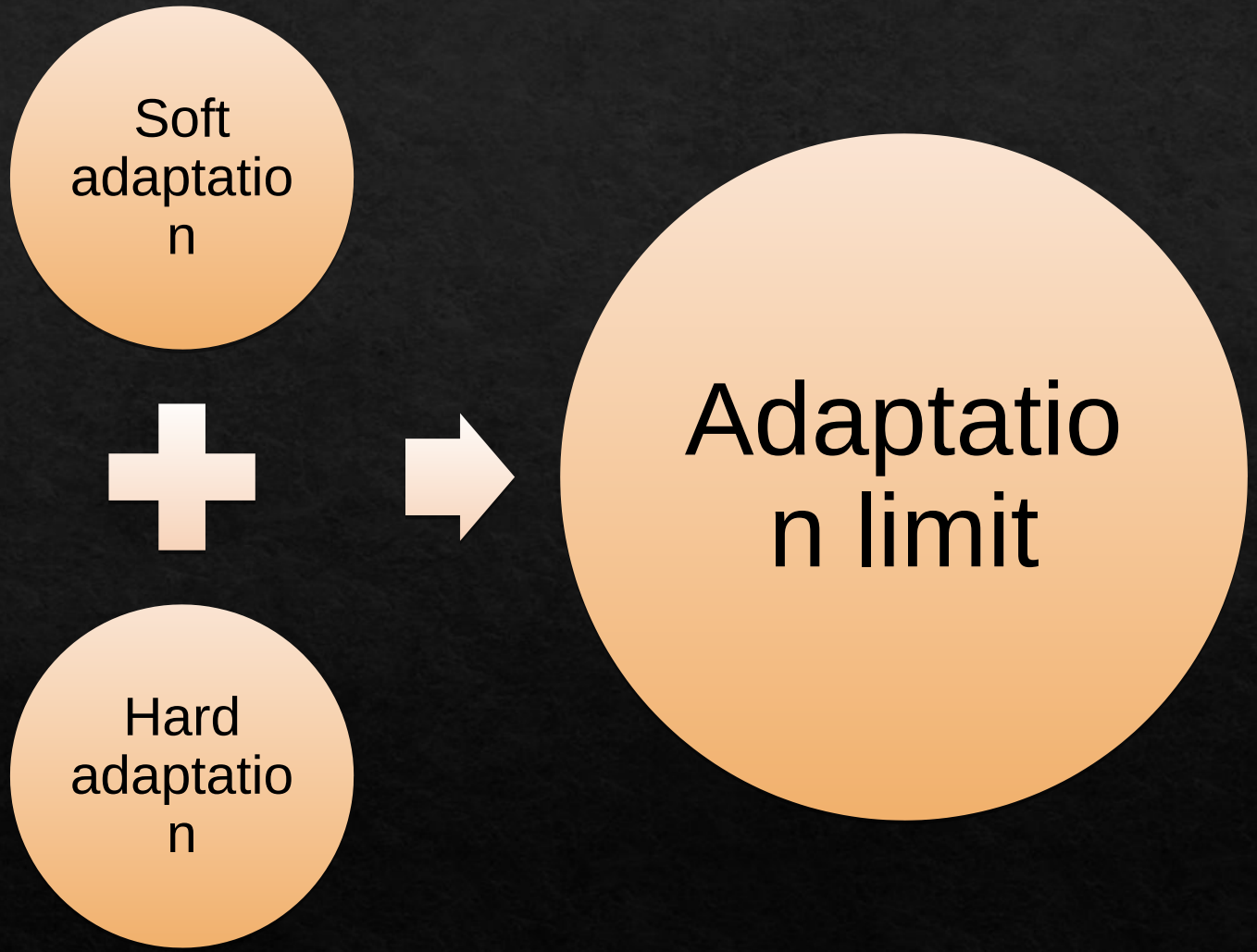
Adaptation constraints



Constraints and Competing Values

Sector	Actor's Adaptation Objective	Adaptation Option	Real or Perceived Trade-off
Agriculture	• Enhance drought and pest resistance; enhance yields.	• Biotechnology and genetically modified crops.	• Perceived risk to public health and safety; ecological risks associated with introduction of new genetic variants to the natural environments
Biodiversity	• Enhance capacity for natural adaptation and migration to changing climatic conditions	• Migration corridors; expansion of conservation areas	Unknwon efficacy; concerns over property rights regarding land aacquisition; governance challenges

Limits to Adaptation



Effects of Mitigation on Adaptation Opportunities, Constraints, and Limits

- mitigation can prevent or delay catastrophic climate change and the reaching of adaptation limits.
- mitigation can potentially reduce the magnitude of climate change to which human and natural systems must adapt.
- Mitigation of GHG emissions can reduce the likelihood that human or natural systems will experience a limit to adaptation.

Ethical Dimensions of Adaptation Opportunities, Constraints, and Limits

	Ethical Dimension	Commentary	Public Policy issues
Adaptation opportunities	Access to opportunities	Inequitable access to the factors that make it easier to adapt and achieve adaptation objectives.	Whether natiiional or international policy should support more equitable access to adaptation opportunities.
Adaptation constraints	Distribution of constraints	Inequitable distribution of factors that make it harder to plan and implement adaptation actions	Whether natiiional or international policy should reduce or remove constraints to adaptation
Adaptation limits	Differing attitudes to risks	What is deemed an acceptable, tolerable, and intolerable risk will vary across cultures, social groups and individuals	Risk governance is concerned with the balancing differentiated and dynamic attitudes to riskd in alloating resources to managing

Seizing Opportunities, Overcoming Constraints, and Avoiding Limits

- Better understanding and quantification of how future GHG emissions trajectories and climate change translates into impacts would improve understanding of limits to adaptation.
- New institutions and institutional for adaptation research institutions with boundary spanning functions as well as those designed to facilitate adaptation and improve environmental and risk management.
- Institutions engaging in adaptation planning and implementation

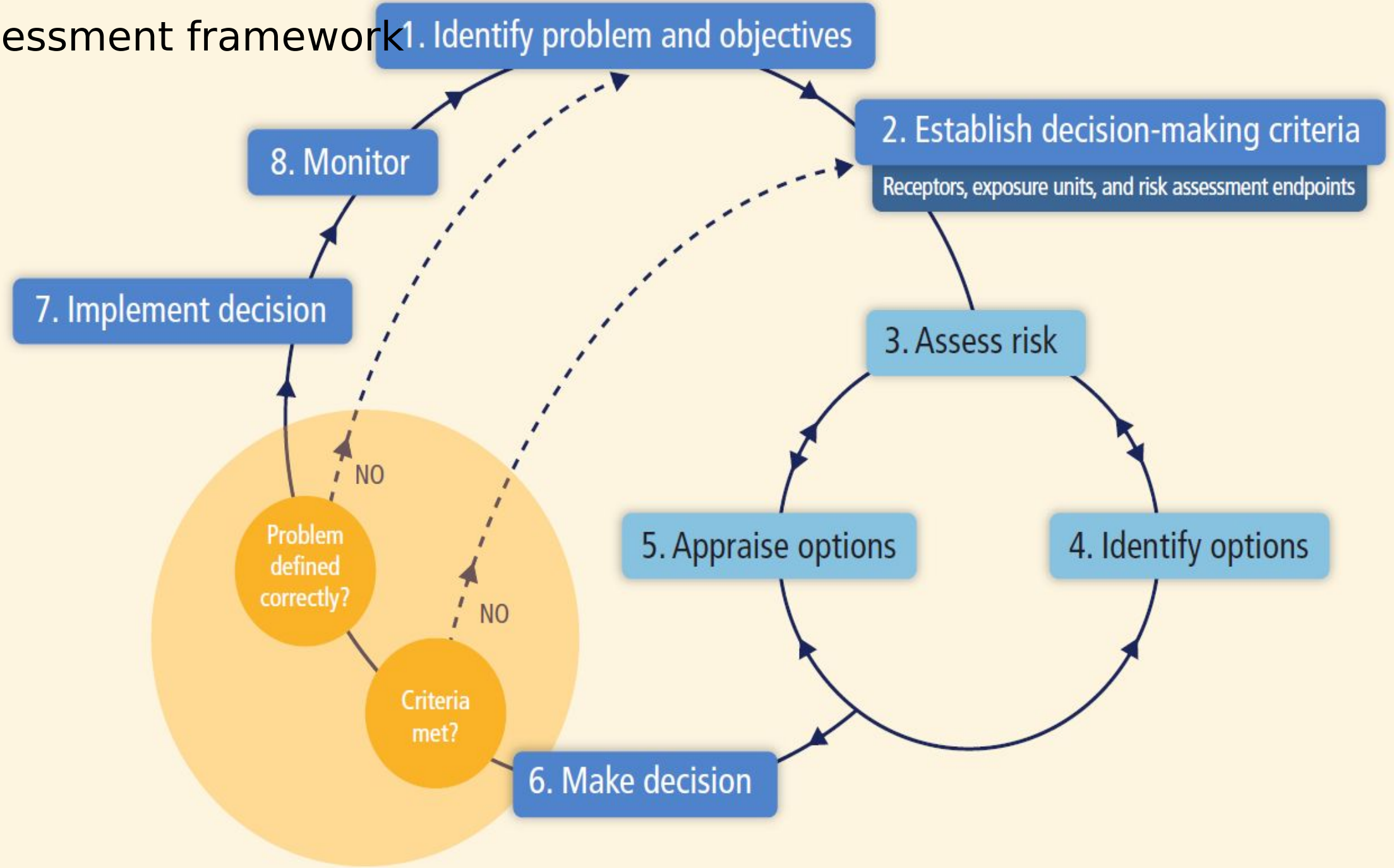
Adaptation Assessments

Types of assessments

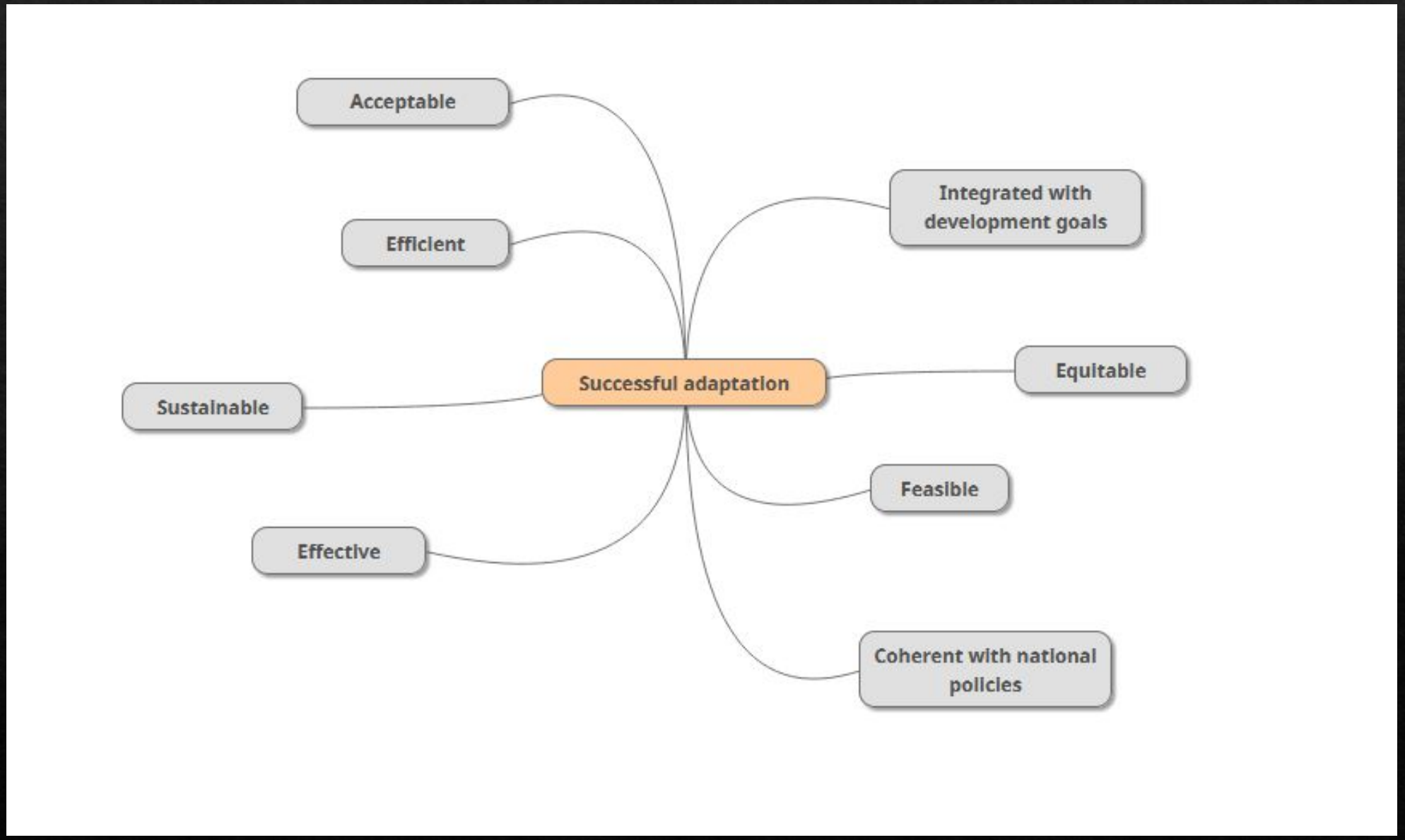
- climate impacts assessments
- risk assessments
- vulnerability assessments
- adaptation options assessments

Trends in Assessments

Assessment framework



Measuring Adaptation



Metrics and their indicators

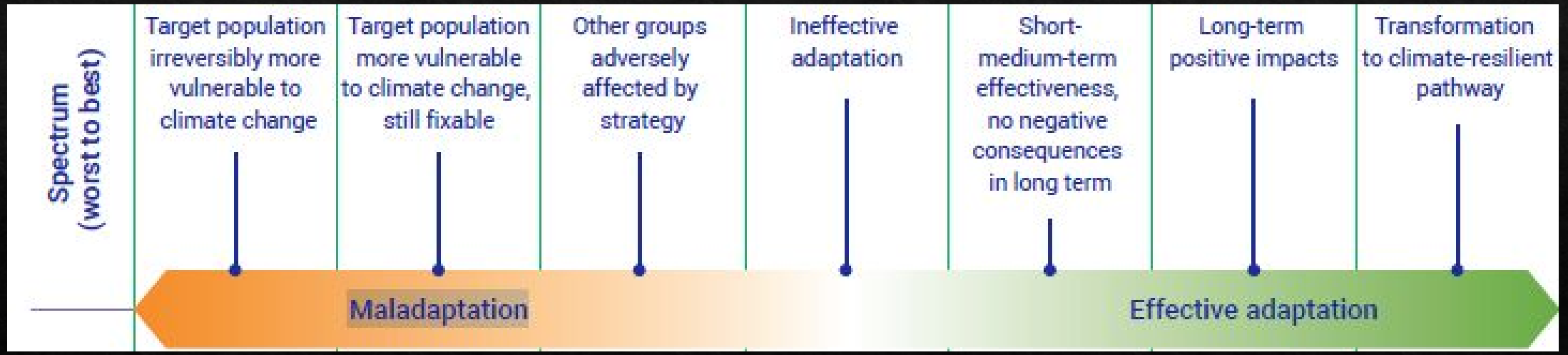
Vulnerability Metrics

Metrics for Monitoring and Evaluation

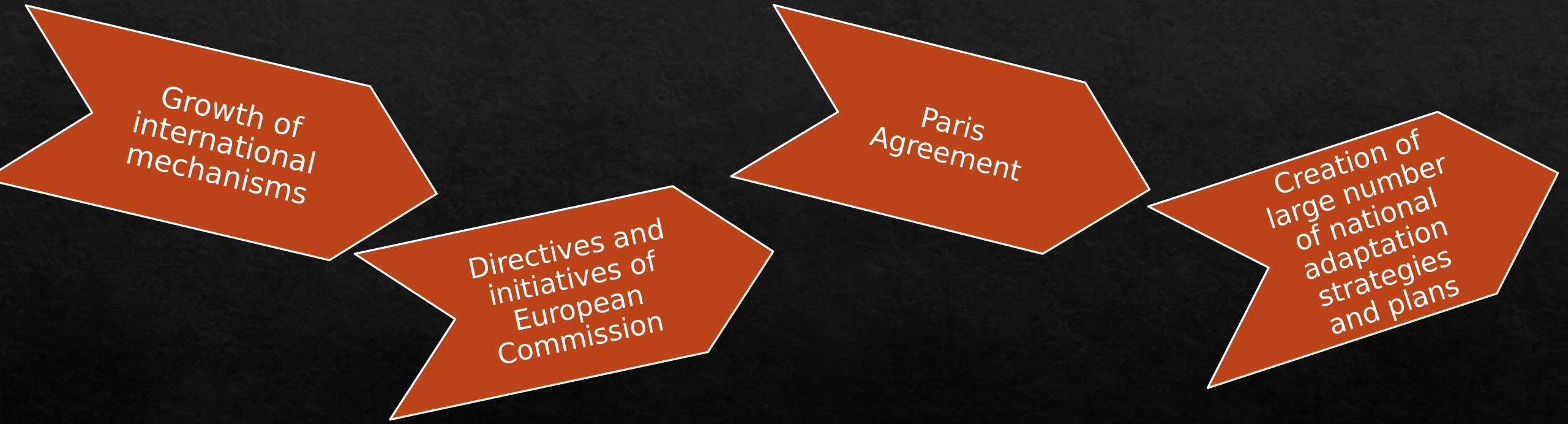
Metrics for process of the implementation

Maladaptation

- Actions that may lead to increased risk of adverse climate-related outcomes, including via increased greenhouse gas emissions, increased vulnerability to climate change, or diminished welfare, now or in the future. Maladaptation is usually an unintended



Adaptation planning


Growth of international mechanisms
Directives and initiatives of European Commission
Paris Agreement
Creation of large number of national adaptation strategies and plans

National Initiatives

National Adaptation Plans and Strategies

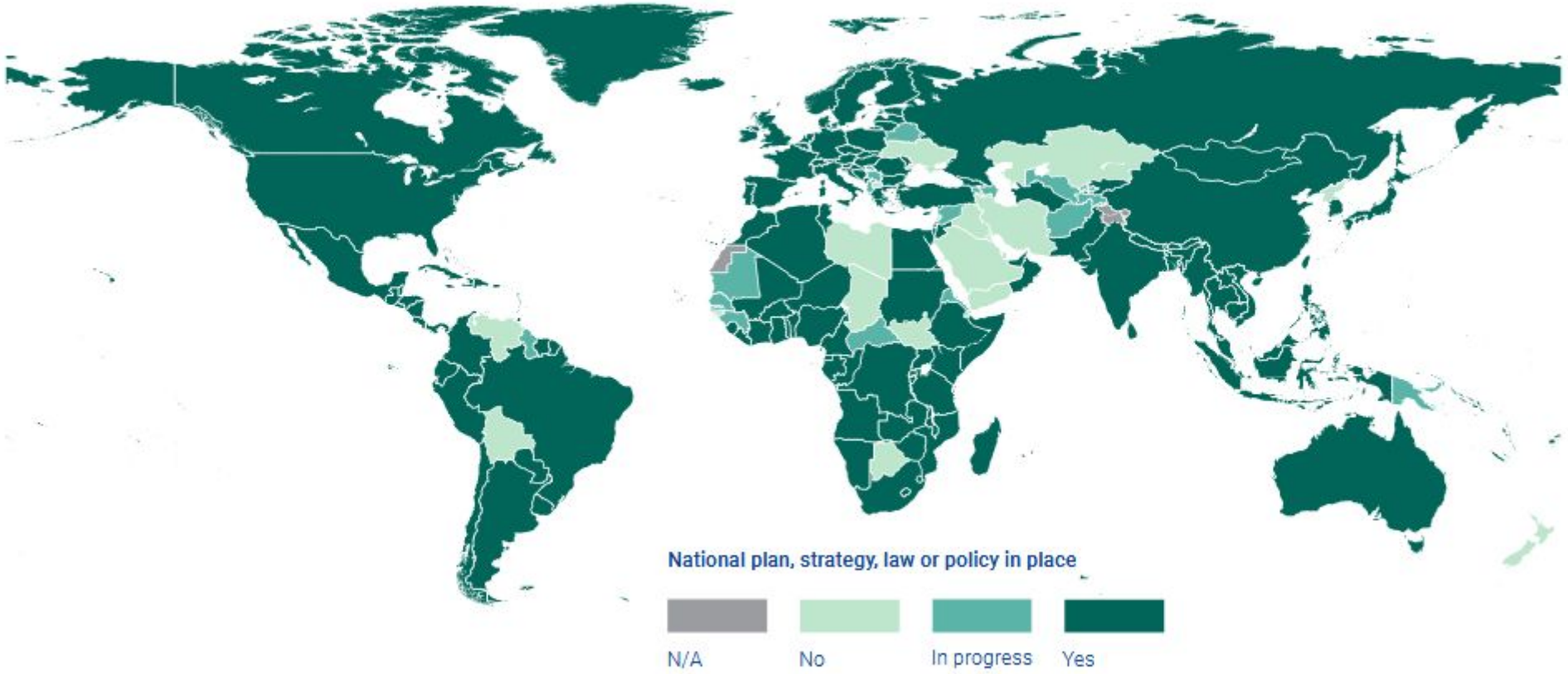
Legal frameworks

Direct actions in sectors and resources

Financial support to other levels of government

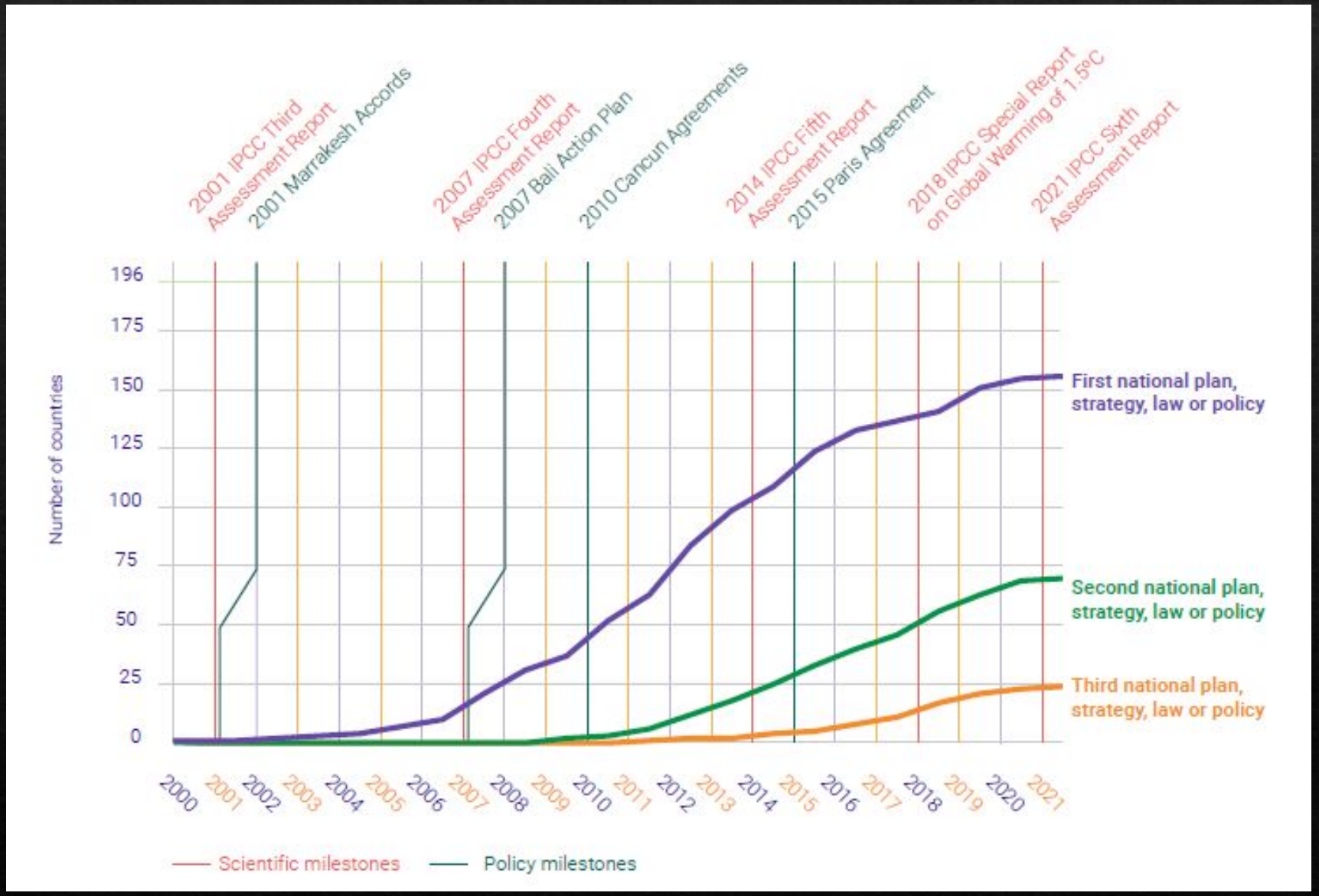
Subnational and Local Activities

Figure ES.1 Status of adaptation planning worldwide, as at 5 August 2021



Note: Territories marked as N/A are those which are recognized as disputed by the United Nations or whose status has not yet been agreed upon.

Progression of global adaptation planning



Implementation

Types of approaches

Top-down approach

- Scenario-driven

Bottom-up approach

- Needs-driven

Projects implementation and funding

- Funded by the three funds serving the Paris Agreement

2006-2021
437
projects

29 new projects in 2021

- Funded by the top 10 adaptation donors

312 projects started in 2019

2010-2019
2607
projects

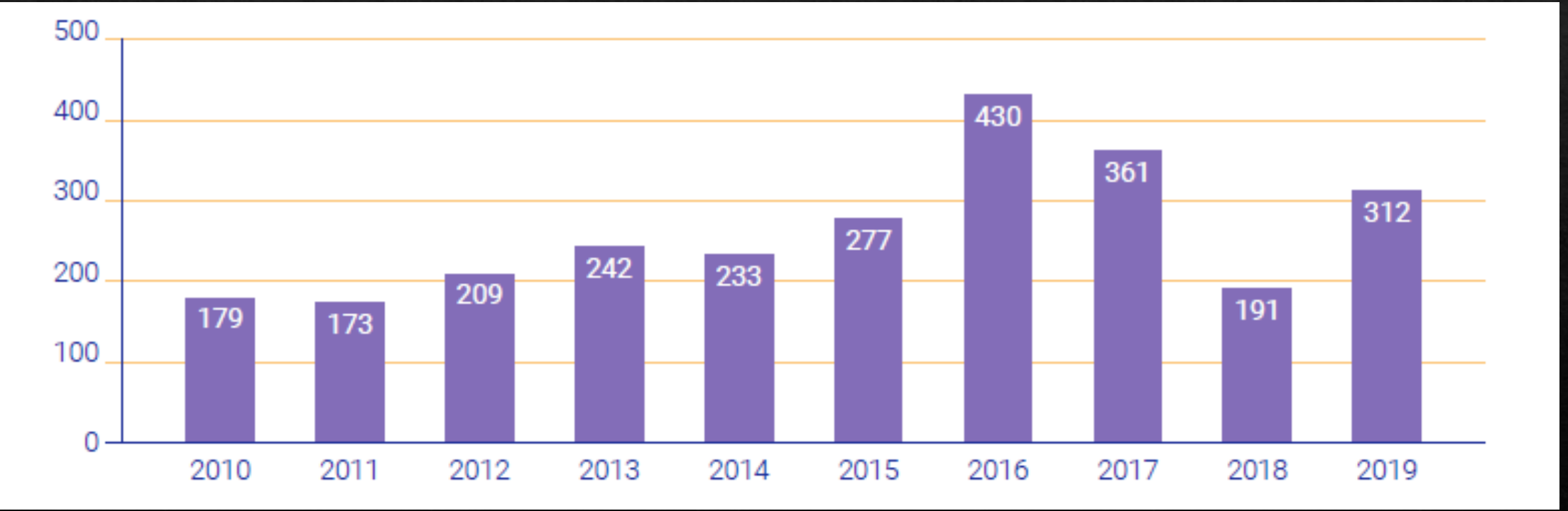
844 projects in total funded by the US

464 projects in total funded by Germany

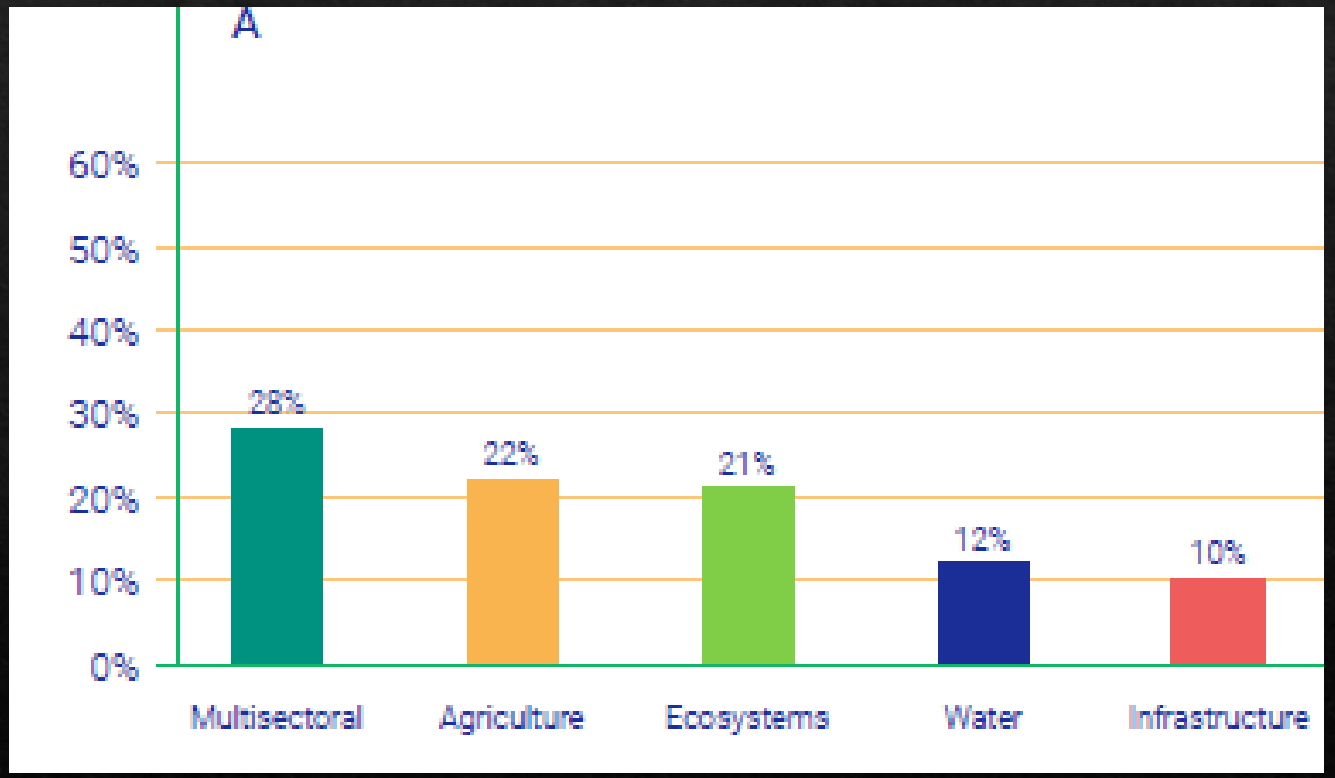
220 projects in total funded by the EU institutions

EU institutions
France
Germany
Japan
Republic of Korea
Netherlands
Sweden
Switzerland
United Kingdom
United States

Number of new adaptation projects started per year with funding from the top 10 adaptation donors



Sectors of projects funded by top 10 donors between 2010 and 2019



TOOLS for implementation

- Monitoring and modeling systems

- Technology

- Communications

- Early warning and information systems

Financial Aspect of Adaptation to Climate Change

Introduction to Economic Aspects of Adaptation

What is the role of Economics in adaptation to climate change ?

Economics and Adaptation

- Role of public and private sector,
- Change of traditional approach to costs and benefits,
- Dynamic approach to adaptation,
- Economic limits of adaptation,
- Uncertainty.

Table 17-1 | Four definitions of eligible adaptation.

Motivation for action	Relevant climatic factors	
	Observed and/or projected climate change	**Climate change as well as natural climate variability**
Climate is the main reason	*Definition 1*: Action occurs mainly to reduce the risks of observed or projected climate change. *Example*: Raising of existing dykes.	*Definition 2*: Action occurs mainly to reduce risks of climate change and climate variability. *Example*: Building of new dykes in areas that are currently unprotected.
Climate is one of several reasons	*Definition 3*: Actions that reduce the risks of observed or projected climate change even if they are also justified in the absence of climate change. *Example*: Economic diversification in predominantly agricultural regions.	*Definition 4*: Actions that reduce the risks of climate change and climate variability even if they are also justified in the absence of climate change. *Example*: Improved public health services.

Source: Füssel et al. (2012), adapted from Hallegatte (2008).

ETHICAL ASPECT?

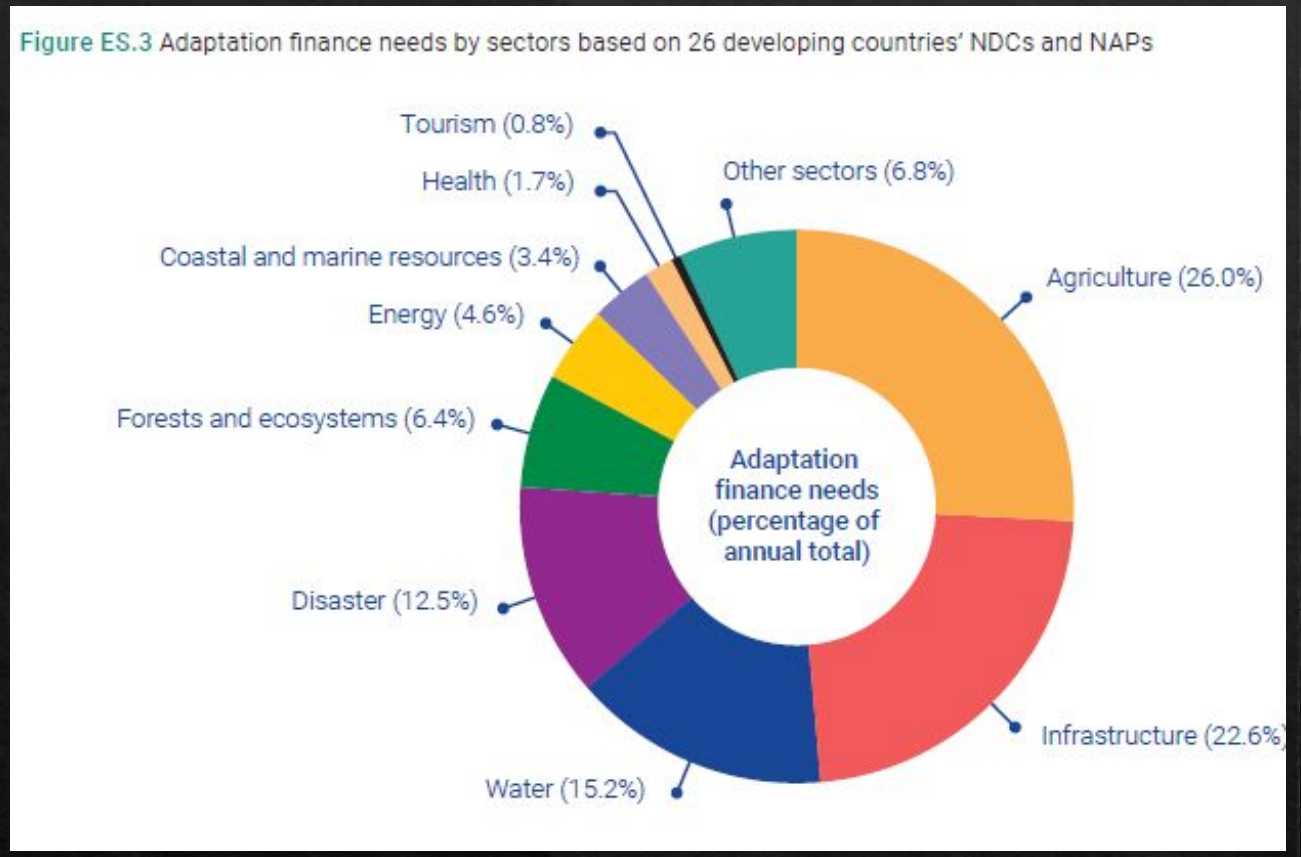
Photo:

What AR5 says about the costs of adaptation?

Table 17-2 | Estimates of global costs of adaptation.

Study	Results (billion US$ per year)	Time frame	Sectors	Methodology and comments
World Bank (2006)	9–41	Present	Unspecified	Cost of climate proofing foreign direct investments, gross domestic investments, and Official Development Assistance
Stern (2007)	4–37	Present	Unspecified	Update of World Bank (2006)
Oxfam (2007)	>50	Present	Unspecified	World Bank (2006) plus extrapolation of cost estimates from national adaptation plans and NGO projects
UNDP (2007)	86–109	2015	Unspecified	World Bank (2006) plus costing of targets for adapting poverty reduction programs and strengthening disaster response systems
UNFCCC (2007)	28–67	2030	Agriculture, forestry and fisheries; water supply; human health; coastal zones; infrastructure	Planned investment and financial flows required for the international community
World Bank (2010a)	70–100	2050	Agriculture, forestry and fisheries; water supply; human health; coastal zones; infrastructure; extreme events	Improvement on UNFCCC (2007): more precise unit cost, inclusion of cost of maintenance and port upgrading, risks from sea level rise and storm surges

Source: Modified from Agrawala and Fankhauser (2008) and Parry et al. (2009) to include estimates from World Bank (2010a).



Nationally Determined Contributions (

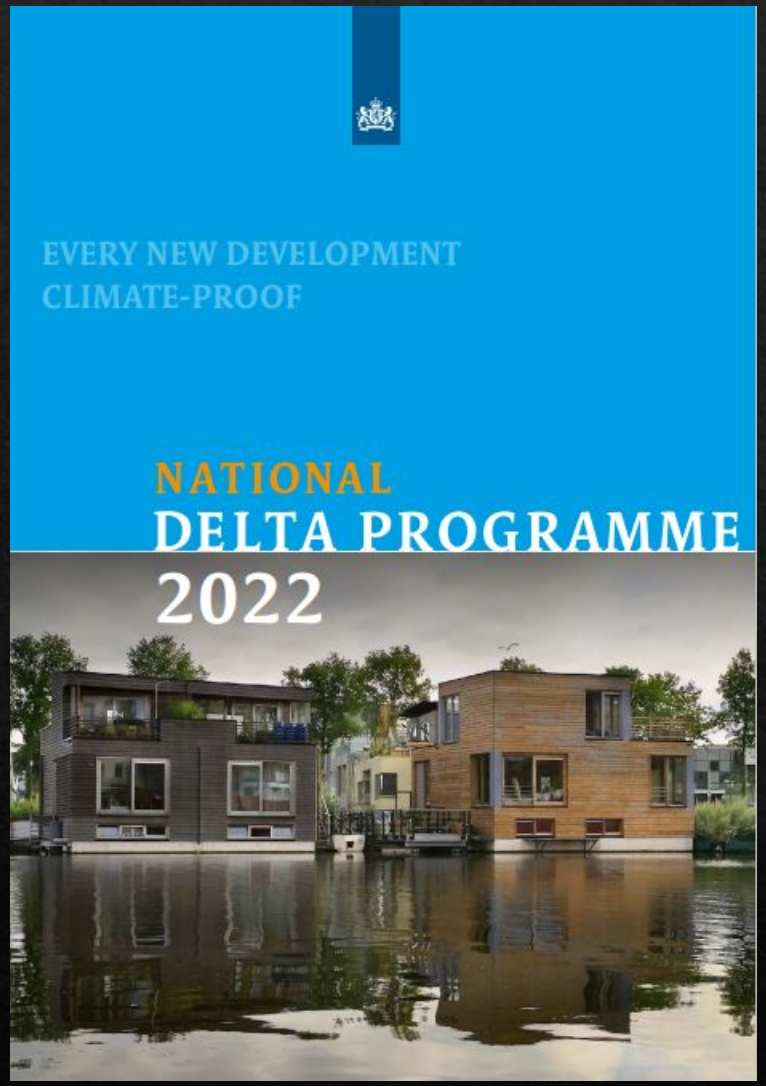
National Adaptation Plans (NAPs)

UN Environmental Programme

COACCH: CO-designing the Assessment of Climate CHange costs

Coastal damage/yr	RCP2.6-SSP2	RCP4.5-SSP2	RCP8.5-SSP5
2050s / mid century	€115-210 Bill/yr	€130-235 Bill/yr	€310 Bill/yr
2080s /end century	€365-795 Bill/yr	€510-1,200 Bill/yr	€2,400 Bill/yr

Coastal adaptation €/yr	RCP2.6-SSP2	RCP4.5-SSP2	RCP8.5-SSP5
2050s / mid century	€14-16 Bill/yr	€15-17 Bill/yr	€17 Bill/yr
2080s / end century	€15-17 Bill/yr	€16-19 Bill/yr	€33 Bill/yr



Local (National) Scale

The average annual budget for 2022-2035 of the Delta Programme is 1.4 billion EUR

Summary

- Cost of adaptation already constitute important part of budgetary spendings of many countries but also individual households
- Importance of the mobilization of ODA to vulnerable countries

- Estimation of the global cost of adaptation is extremely difficult due to uncertainties and lack of data
- Estimations on the local scales are much easier but still vary due to different SSP scenarios

Thank you!