# **Coastal** and **ocean adaptation**

Recommendations to improve the inclusion of **coastal and ocean adaptation** in the **development of National Adaptation Plans**

GERICS Climate Service Center Germany
An institution of Helmholtz-Zentrum hereon

Helmholtz-Zentrum hereon

GEO BLUE PLANET

MERCATOR OCEAN INTERNATIONAL

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**For content support or feedback please contact GERICS-Hereon** (cs-sekretariat@hereon.de) **or GEO Blue Planet** (info@geoblueplanet.org).

**Coordinating authors:** Louis Celliers (Climate Service Centre Germany, Helmholtz-Zentrum Hereon), David Cabana (Climate Service Centre Germany, Helmholtz-Zentrum Hereon) and Audrey Hasson (GEO Blue Planet/Mercator Ocean International).

**Contributing authors:** Joydeep Chakrabarrty, Rauha Firaq, Tania Guillén Bolaños, María Máñez Costa, Simon Peter Muwafu, Giulia Motta-Zanin, Lisa-Maria Rebelo, Emily Smail and Torsten Weber.

**Review contributors:** Sara Venturini and Rui Kotani (GEO Secretariat), Shannon Hampton (AfriSeas Solutions), Marcelo Uriburu (Argentina National Space Activities Commission, GEO Disaster Risk Reduction and Adaptation Working Group), Mikaël JA Maes (Organisation for Economic Co-operation and Development [OECD], GEO-CC-WG), Gensuo Jia (CAS, GEO Climate Change Working Group [GEO CC-WG]), Alexis Foussard (Ministry for Transition Ecologique-France; GEO CC-WG) and Begoña Pérez Gómez (Puertos).

**Editing:** Claire Ward (Fishmedia)
**Graphic design:** Janenne Smit and Janette Mayne (Cohoots in Design)

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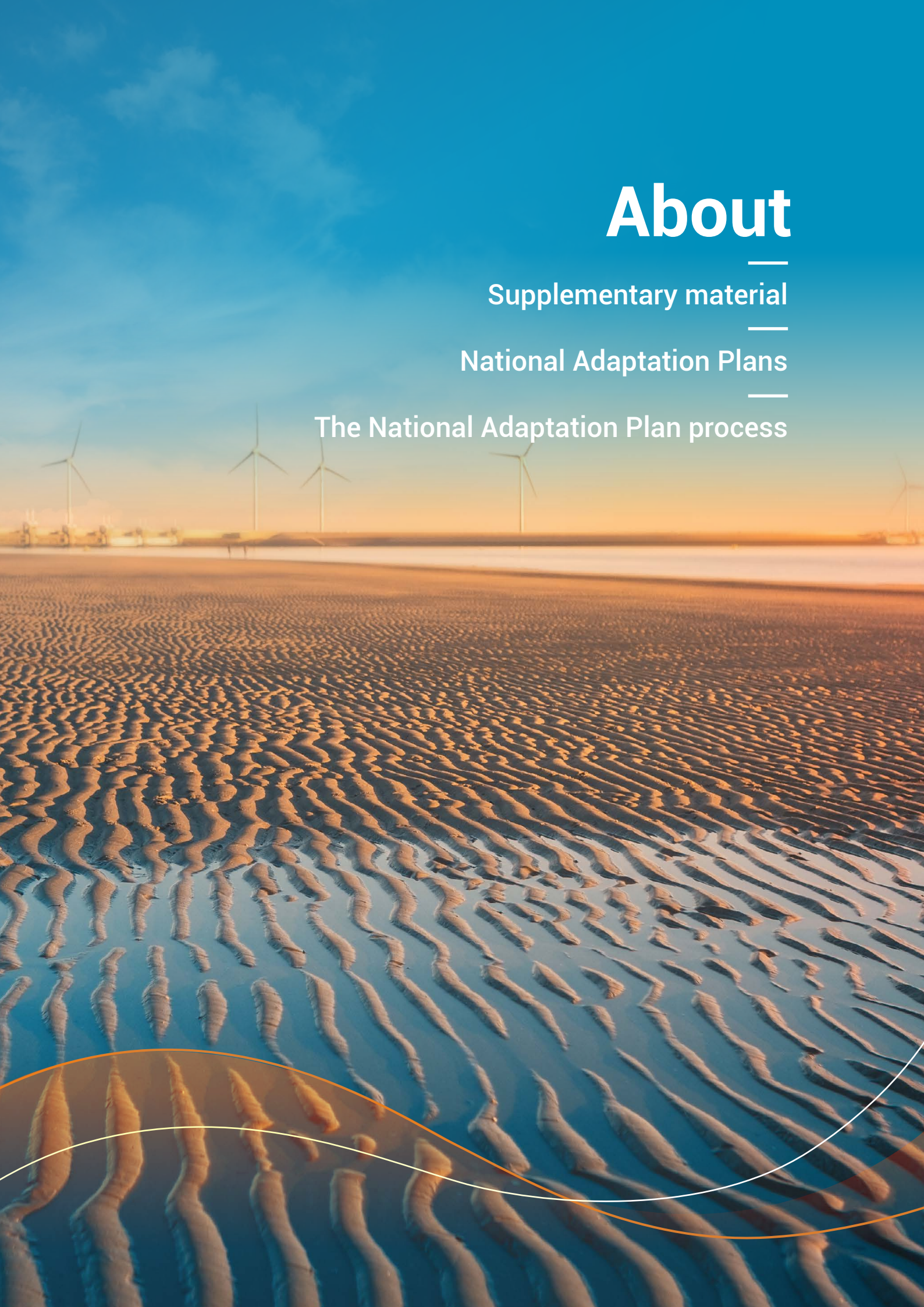
# Contents



## Articles

## Abbreviations

| | |
|---|---|
| **CORDEX** | Coordinated Regional Climate Downscaling Experiment |
| **CMA** | Conference of the Parties serving as the Meeting of the Parties to the Paris Agreement |
| **CORE** | Coordinated Output for Regional Evaluations |
| **DSS** | Decision Support System |
| **DRR** | disaster risk reduction |
| **DRRA-WG** | Disaster Risk Reduction and Adaptation Working Group |
| **EbA** | ecosystem-based adaptation |
| **FAIR** | findable, accessible, interoperable and re-usable (information) |
| **GEO** | Group on Earth Observations |
| **GEO CC-WG** | Group on Earth Observations Climate Change Working Group |
| **GDP** | gross domestic product |
| **GERICS** | Climate Service Centre, Germany |
| **GGA** | Global Goal on Adaptation |
| **ICZM** | integrated coastal zone management |
| **IPCC** | Intergovernmental Panel on Climate Change |
| **MSP** | marine spatial planning |
| **LDC** | least developed countries |
| **M&E** | monitoring and evaluation |
| **MPA** | marine protected area |
| **NAP** | National Adaptation Plan |
| **NbS** | nature-based solution |
| **OECD** | Organisation for Economic Co-operation and Development |
| **NGO** | non-governmental organization |
| **RCPs** | Representative Concentration Pathways |
| **SDG** | Sustainable Development Goal |
| **SEDAC** | Socioeconomic Data and Applications Centre |
| **SIDS** | Small Island Developing States |
| **SSP** | Shared Socioeconomic Pathway |
| **SROCC** | Special report on the ocean and cryosphere in a changing climate |
| **UNFCCC** | United Nations Framework Convention on Climate Change |
| **UNESCO** | United Nations Educational, Scientific and Cultural Organization |
| **WMO** | World Meteorological Organization |



# About

## Supplementary material

## National Adaptation Plans

## The National Adaptation Plan process

# About this supplementary material

**This supplementary material to the *Technical guidelines for the National Adaptation Plan process* recommends ways to include coastal and ocean adaptation requirements in the development of National Adaptation Plans (NAPs). This can be done by:**

- including coastal and ocean-specific adaptation requirements in NAPs; or
- developing stand-alone coastal and ocean NAPs.

This supplementary material is not intended to guide the development of NAPs. Such guidance is provided by the Technical guidelines for the National Adaptation Plan process (2012).

## Who should use this supplementary material?

This supplementary material is intended to support least-developed countries (LDCs)[1] and Small Island Developing States (SIDS)[2] but it can be used by all countries to prioritize coasts and oceans in their climate change adaptation planning.

## How does it work?

**This document is presented in two parts.**

- **Part 1** consists of six **"pillars of knowledge"** and five "other considerations" that provide context and knowledge to assist LDCs that are considering the inclusion of coasts and oceans and associated Blue Economy[3] sectors as priority areas in the development of NAPs.
- **Part 2** provides practical guidance to assist LDCs to improve or initiate the inclusion of coastal and ocean adaptation requirements in the NAP development process. This guidance links back to and is supported by the information provided in Part 1. It is organized into six elements. Each element is broken down into practical steps and activities, with useful recommendations for implementation.

**This supplementary material incorporates some elements of the draft updated NAP Technical Guidelines (version of 20 May 2025). It will be updated once the NAP Technical Guidelines are finalized.**

The fifth meeting of the Conference of the Parties, serving as the meeting of the Parties to the Paris Agreement (CMA5) asked the Least Developed Countries Expert Group (LEG) to update the Technical Guidelines for the NAP process. The updated guidelines should reflect the decisions made under Decision 2 of the CMA5, which relates to the Global Goal on Adaptation and consider the best available science, including findings from the Sixth Assessment Report of the Intergovernmental Panel on Climate. It also urged Parties that have not yet done so to establish their NAPs, policies and plans by 2025 and to make meaningful progress in implementing them by 2030.

**Source: UNFCCC-LEG.** 2025. *NAP Technical Guidelines. Updated version May 2025.* Bonn, Germany, United Nations Framework Convention on Climate Change – Least Developed Countries Expert Group. https://unfccc.int/documents/646945

[1] https://www.un.org/ohrlls/content/list-ldcs

[2] https://www.un.org/ohrlls/content/list-sids

[3] The term "Blue Economy" encapsulates the idea of using ocean resources (e.g., fisheries, marine and coastal tourism and renewable energy) in a way that boosts the economy, supports coastal communities and protects the environment. For more information see: www.un.org/regularprocess/sites/www.un.org.regularprocess/files/rok_part_2.pdf

A separate technical report presents a detailed, fully referenced exploration of the science behind the six pillars (Celliers *et al.*, 2025).

This document has been designed with a busy reader in mind. Its purpose is to serve as a quick-reference guide, allowing readers to easily access the information or guidance they need without having to sift through extensive text. **While the document is concise, it is grounded in thorough and comprehensive research (Part 1).** Most of the information is presented in tables or summaries and numerous links and references are included to help readers swiftly find additional details on specific topics of interest. **In Part 2**, the guidance on including coastal and ocean adaptation aligns with the NAP development guidance provided by the UNFCCC.

## Engagement with societal actors

It is intended that this supplementary material be periodically updated and reissued. It is hoped that it will be used, put into practice and reviewed in LDCs so that good practices can be included in future versions of the material through a process of dynamic or rolling stakeholder engagement. Feedback on the supplementary material is welcome and users are requested to contact either GERICS or GEO Blue Planet for input to future versions of the material.

## Supplementary materials

Supplementary materials are intended to support the formulation and implementation of NAPs. They are in-depth explanations that bolster NAP development and facilitate the successful implementation of NAPs.

The full and growing list of NAP supplementary materials can be found in an online library at: [https://napcentral.org/supplementary-materials-library](https://napcentral.org/supplementary-materials-library).

This document adds to the library of supplementary materials. It provides guidance for improving the inclusion of coastal and ocean adaptation requirements in the NAP development process.

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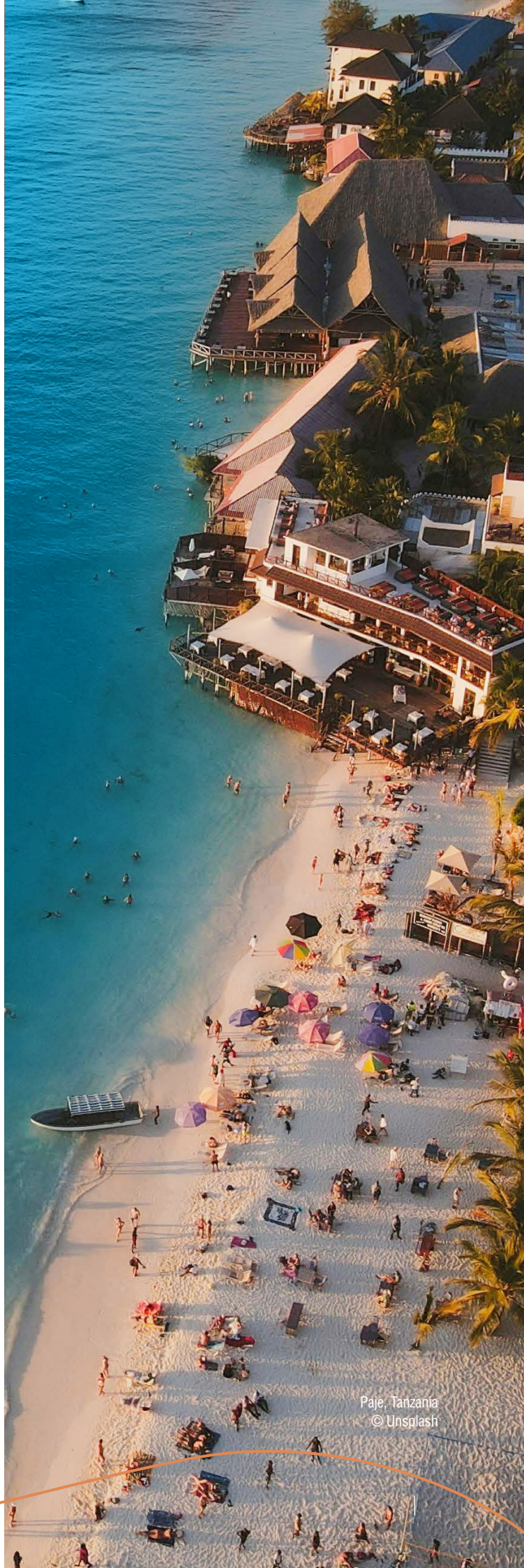
[4] **Celliers, L., Cabana, D., Hasson, A., Chakrabarrty, J., Firaq, R., Guillén Bolaños, T., Máñez Costa, M., Mawafu, S.P., Motta-Zanin, G., Rebelo, L-M., Smail, E. & Weber, T.** 2025. *Coastal and ocean adaptation. A technical report to develop recommendations to improve the inclusion of coastal and ocean adaptation in the development of National Adaptation Plans.* Hamburg, Germany, GERICS-Hereon and GEO Blue Planet.



Paje, Tanzania
© Unsplash

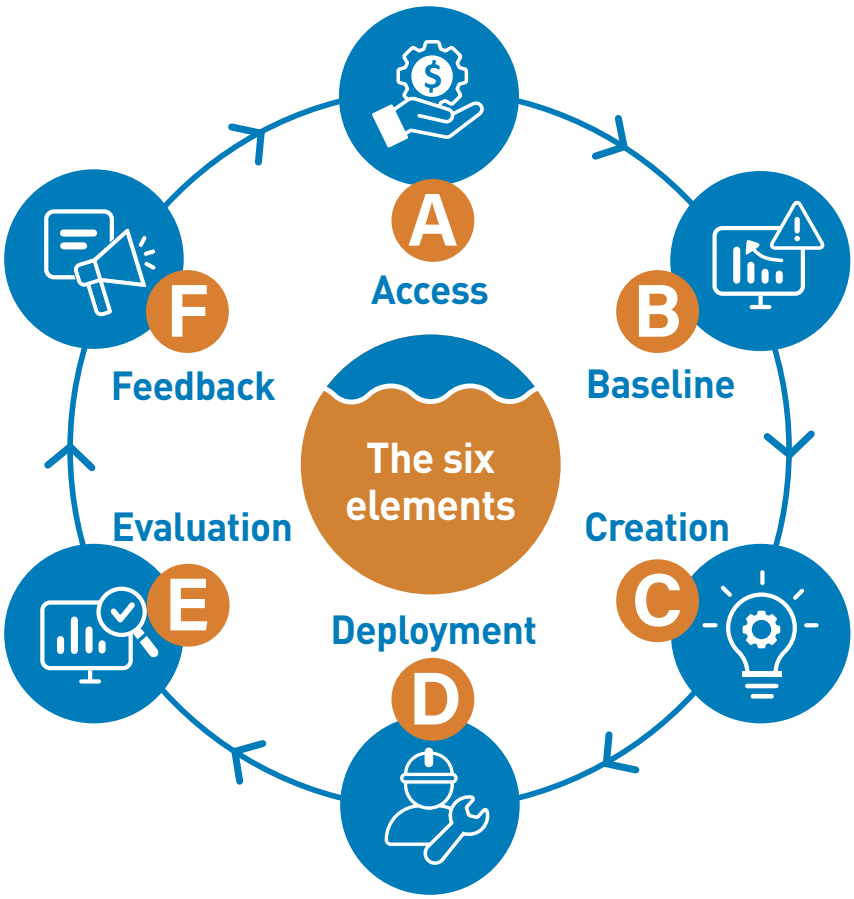
# About National Adaptation Plans

**Adaptation to climate change is a universal challenge with local to international dimensions. It is vital for an effective response to climate change, protecting people, livelihoods and ecosystems, especially in developing countries.**

Adaptation efforts should be country-driven, gender-responsive, intersectional, participatory and transparent. They should be responsive to the vulnerabilities of different population subgroups – which can vary by location – as well as those of communities and ecosystems, using the best available science and traditional knowledge to integrate adaptation into relevant policies and actions. In other words, adaptation actions must be specifically designed for specific contexts.

NAPs help countries, particularly developing countries, to identify their medium- and long-term adaptation needs and to formulate strategies to address these needs. The plans enable countries to translate the high-level objectives of the Paris Agreement[4] into practical, context-specific measures that bolster resilience at all levels. The structured approach of NAPs ensures that adaptation efforts are not only forward-looking but also responsive to current and emerging climate risks.

**Figure 1. The National Adaptation Plan process is designed to be continuous, progressive and implemented step by step**




[4] The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 Parties at the United Nations Climate Change Conference in Paris, France, on 12 December 2015. It entered into force on 4 November 2016. For more information see: https://unfccc.int/process-and-meetings/the-paris-agreement

# The National Adaptation Plan process

**The NAP process was established by the UNFCCC following the Sixteenth Conference of the Parties held in Mexico in 2010.**

The process has two main goals:

- To reduce vulnerability to the impacts of climate change by strengthening adaptive capacity and resilience.
- To integrate climate change adaptation into relevant new and existing policies, programmes and activities in a coordinated way.

**The NAP implementation process is designed to be continuous, progressive and implemented step by step. It is guided by six main elements.**

The information and guidance presented in this supplementary material is structured around these six elements which are illustrated in Figure 2.

Piton Mountain, Soufriere, Saint Lucia, West Indies, eastern Caribbean
© AdobeStock

**Figure 2. The six elements and steps of the National Adaptation Plan technical guidelines**


## Access

**Maintaining the NAP process by accessing funding, data and capacity-sharing**[5]

- Access Green Climate Fund NAP readiness funding and explore other sources to help design and implement NAPs, capacity-sharing and related enabling activities
- Prepare the groundwork for implementation, including planning and mobilizing resources to address climate change
- Build or update a knowledge base to support the NAP
- Strengthen institutional arrangements and regulatory frameworks


## Baseline

**Assessment and pre-planning**

- Develop likely climate change and socioeconomic scenarios for the medium and long term
- Document baseline climate hazards, vulnerabilities, risks and impacts of climate change
- Conduct assessments of climate hazard and exposure, vulnerability and risk


## Creation

**Plan development**

- Understand the country's development vision and the major thrusts of that aspirational vision
- Frame adaptation at the national level in the context of the GGA's thematic targets
- Synthesize the best available information on climate hazard and exposure, vulnerability and risk from relevant assessments
- Identify options to address key climate risks and vulnerabilities and build resilience
- Estimate costs for implementation
- Compile the NAP and prepare it for endorsement and submission to the UNFCCC (after Element D)


## Deployment

**Implementation and financing strategy and resource mobilization**

- Develop a resource mobilization strategy
- Implement and execute adaptation and risk management and resilience solutions


## Evaluation

**Monitoring, evaluation and learning**

- Collect data systematically to inform adaptation and monitoring, including progress
- Carry out regular evaluations to support learning and improvement


## Feedback

**Reporting**

- National reporting
- International reporting

[5] Capacity-sharing is an evolving concept that goes beyond traditional "capacity-building" by emphasizing a collaborative and equitable approach to development and sustainability. It recognizes that expertise, resources, and influence can be shared in multiple directions among all participants within a system. https://www.nature.com/articles/s44183-023-00015-9

## Coastal and ocean adaptation and National Adaptation Plans

There are at least three options for including coastal and ocean adaptation requirements in the development of NAPs. One option is a Coastal and Ocean NAP as a separate document (sectoral NAP), the other is to include coastal and ocean considerations within NAPs. A third option is to integrate coastal and ocean adaptation in a multisectoral NAP.

**Countries can choose to develop a standalone or sectoral NAP that focuses on coasts and oceans.** Examples of this specialized and focused mechanism are from:

**Uruguay**

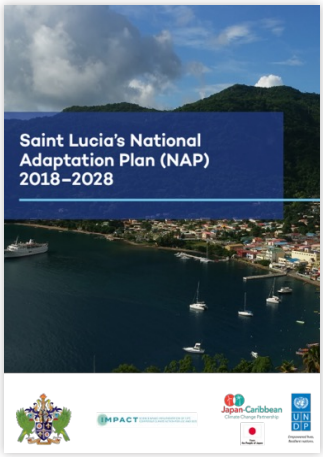
National Adaptation Plan to Climate Change and Variability for Coastal Zone in Uruguay (Coastal-NAP)

The coastal NAP contains two primary sections, one dealing with the coastal context of Uruguay and a second that features the adaptation strategy. The strategy includes sections on adaptation capacities; gaps and needs; adaptation lines of action at national and subnational levels; adaptation measures; a long-term strategy for implementing adaptation at the national level; and a strategy for consultation and participation.

**South Africa**

Climate change adaptation response plan for South Africa's coastal sector

The *Climate change adaptation response plan for South Africa's coastal sector* contains sections on the coastal setting or background, guidance on the implementation of adaptation response and climate response according to coastal element.


**Countries can choose to embed the coastal and ocean sector within their NAPs.**

**Saint Lucia**

Saint Lucia's National Adaptation Plan (NAP) 2018–2028

Saint Lucia has also embedded coastal and ocean considerations in sectors of the NAP, e.g., natural resource management (terrestrial, coastal and marine), fisheries and tourism.

**Countries can choose to integrate coastal and ocean adaptation in a multisectoral NAP.** For example:

**Brazil**

National Adaptation Plan to Climate Change and the possible impacts in Brazil and South America

Brazil has integrated coastal adaptation measures with 10 other sectors (e.g., agriculture, cities and health) in an integrated multisectoral NAP. Climate change vulnerability and proposed guidelines for managing risk associated with climate change, with the goal of increasing climate resilience, are presented for the coastal zone as a sector.

All options are correct and useful for increasing coastal and ocean adaptation linked to NAP development and implementation. Some reasons for developing a specialized and focused sectoral NAP may include:

- a large contribution to gross domestic product (GDP) from the maritime economy (e.g., shipping, ports, fishing and coastal cities) and coastal activities such as tourism or small-scale or subsistence fishing
- a high expectation for the Blue Economy to contribute to GDP in the future
- a high level of dependence by coastal communities on climate-sensitive livelihoods (e.g., small-scale fisheries, aquaculture, coastal agriculture, local tourism and artisanal activities) which are directly threatened by climate change impacts such as sea level rise, ocean warming, salinization and extreme weather events a high degree of climate change risk to coastal populations and substantial coastal infrastructure at risk
- substantial contributions to biodiversity from coastal and ocean areas (mangroves, coral reefs, estuaries, etc.)
- strong institutions and resources are available to increase and improve adaptation responses to coastal and ocean climate change

# Part 1
# The knowledge base

## The six pillars

## Five other considerations

Women working in a seaweed plantation, east Tanzania.
© Depositphotos

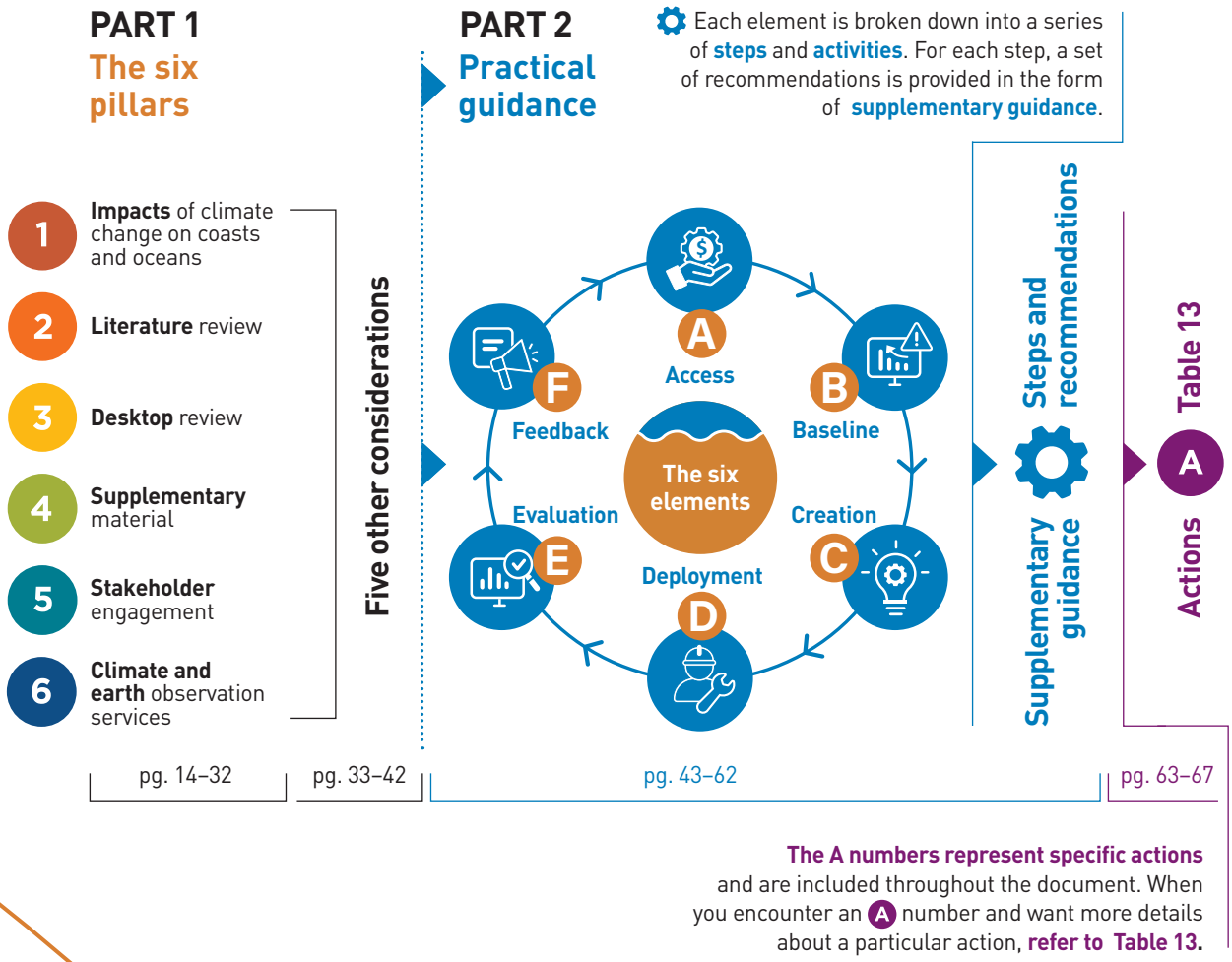
# The six pillars

**The six pillars for improving the inclusion of coastal and ocean adaptation requirements in the development and implementation of NAPs represent:**

- What we know about the impacts of climate change on coastal and ocean ecosystems.
- What we can learn from the literature, existing NAPs, stakeholders and science about how to include coastal and ocean adaptation requirements in the development of NAPs.

Together, the six pillars (and five "other considerations") form a strong foundation of knowledge on which to build a NAP that includes coastal and ocean adaptation requirements. The guidance that is presented in Part 2 of this document draws on this strong foundation of knowledge.

**Figure 2. How to navigate this document**



PILLAR 1

# 1 The impacts of climate change

This pillar provides a broad overview of vulnerability and risk for global coasts and oceans. This is already sufficient to justify the inclusion of coastal and ocean adaptation requirements in NAPs, but more detail and context may be needed for each country.

**Observations, projections and solutions from the Sixth Assessment Report of Working Group 2 of the Intergovernmental Panel on Climate Change**

A1 Risks
REFER TO PG. 63

## OBSERVATIONS: What can already be observed?

- Climate change worsens the impacts of human activities on marine life, e.g., habitat degradation, marine pollution, overfishing, nutrient enrichment and the introduction of non-indigenous species.
- Climate-driven impacts on coastal and ocean environments have caused measurable negative changes in specific industries, economic losses, emotional harm and altered cultural and recreational activities around the world.
- A striking example is marine heatwaves lasting weeks to several months which expose species and ecosystems to environmental conditions beyond their tolerance and acclimation limits.

## PROJECTIONS: What is likely to happen in the future?

- Ocean conditions are projected to continue changing when measured against their pre-industrial state.
- Climate impacts on coastal and ocean ecosystems will be exacerbated by increases in the intensity, frequency and duration of marine heatwaves.
- Escalating impacts of climate change on marine life will further alter the biomass of marine animals, the timing of seasonal ecological events and the geographic ranges of coastal and ocean organisms, disrupting life cycles, food webs and ecological connectivity.
- Risks from sea level rise for coastal ecosystems and people are very likely to increase tenfold, well before 2100, without adaptation and mitigation action.
- Climate change will alter many ecosystem services provided by marine systems.

## SOLUTIONS: What can be done?

- Humans are already having to adapt to climate-driven changes in marine systems.
- Available adaptation options are unable to offset climate change impacts on marine ecosystems and the services they provide. Adaptation solutions implemented at appropriate scales, when combined with ambitious and urgent mitigation measures, can meaningfully reduce impacts.
- Nature-based solutions for adaptation of ocean and coastal ecosystems can achieve multiple benefits when well designed and implemented, but their effectiveness declines without ambitious and urgent mitigation.
- Development planning must consider adaptation measures and disaster risk reduction (DRR) for the short, medium and long term.
- Ocean-focused adaptation options should employ nature-based solutions, address existing inequalities, incorporate just and inclusive decision-making and implementation processes, and support the United Nations' Sustainable Development Goals (SDGs).

**The Intergovernmental Panel on Climate Change (IPCC) Special Report on the Ocean and Cryosphere[6] in a changing climate, also known as the SROCC proposes strengthening response options. These can be taken up in NAPs and adaptation planning (adapted from the SROCC of the IPCC Sixth Assessment Report):**

- **Establishing networks of protected areas** helps maintain ecosystem services, can accommodate species migrations and enables future ecosystem-based adaptation (EbA) options.
- **Community-supported and knowledge-based (scientific and indigenous) terrestrial and marine habitat restoration** can be locally effective in enhancing EbA.
- **Strengthening precautionary approaches**, such as rebuilding overexploited or depleted fisheries and the responsiveness of existing fisheries management strategies reduces negative climate change impacts on fisheries.
- **Restoration of vegetated coastal ecosystems**, such as mangroves, tidal marshes and seagrass, could provide climate change mitigation.
- **Ocean renewable energy** e.g., wind, tidal, wave, thermal and salinity gradient and algal biofuels can support climate change mitigation.
- **Coastal protection** is more challenging the higher the sea levels rise.
- **Reducing local drivers of exposure and vulnerability**, such as coastal urbanization and human-induced subsidence, are effective responses.
- All options, including **protection (e.g., sea walls), accommodation (adapting to new conditions), EbA, coastal advance (actions to expand or extend coastal areas) and planned relocation**, can play important roles in integrated responses.
- **Easing governance challenges** relating to sea level rise and associated risk reduction can be achieved using locally appropriate combinations of decision analysis, land-use planning, public participation, diverse knowledge systems and conflict resolution approaches. Governance should also address issues relating to climate justice and equity.
- **Coastal decisions with time horizons** of decades to over a century are being made now and can be improved by taking relative sea level rise into account.

Village on South Tarawa atoll, Kiribati, Gilbert islands ©AdobeStock

[6] The **cryosphere** is an umbrella term for those portions of Earth's surface where water is in solid form. This includes sea ice, ice on lakes or rivers, snow, glaciers, ice caps, ice sheets and frozen ground. (*Source:* Wikipedia.)

# 2 PILLAR 2 Literature review

This pillar presents a summary of information provided by academic and non-peer reviewed (grey) literature.

**Table 2. Recommendations from a literature review to improve the inclusion of coasts and ocean adaptation requirements in the National Adaptation Plan development process**

| TOPIC | KEY FINDING | RECOMMENDATIONS | ACTIONS |
|---|---|---|---|
| **Climate futures** | • NAPs conceptually acknowledge future risk and vulnerability trends, but only a few thoroughly assess them.<br>• NAPs should include awareness of potential risks along coastlines. | • Include current and future decision-making contexts in NAP development, i.e. immediate actions to reduce coastal community risk and vulnerability and staggered or scheduled actions for the medium and long terms. | A 1 Risks<br>A 2 Obtain expert assistance<br>A 3 Data and information |
| **Implementation guidance and evaluation** | • There is little research on implementing adaptation policies.<br>• Implementation guidance and evaluation metrics are often overlooked in planning. | • Countries could form multi-agency, multilevel teams to address implementation, monitoring and evaluation (M&E) of the NAP process, including financing of actions. | A 4 Leverage networks<br>A 5 Organize relationships |
| **Local adaptation experience** | • NAPs often overlook local experiences, limiting local adaptation effectiveness due to centralized power and lack of diverse governance. | • Recognizing localized problem-solving is crucial. The challenge is to recognize impacts across scales and plan actions among many actors, some that operate at different scales and levels of administration. | A 4 Leverage networks<br>A 5 Organize relationships<br>A 6 Stakeholder action |
| **Existing policies** | • Adaptation planning should use existing coastal management laws, policies and other relevant instruments, or support their revision or update. These include policies on integrated coastal zone management (ICZM); marine spatial planning (MSP); marine protected areas (MPAs); coastal property laws; and measures to achieve the SDGs. | • NAP development processes should consider the existing coastal and ocean management mechanisms and institutions. Institutions legally responsible for implementing these mechanisms automatically become stakeholders in the NAP development and implementation process.<br>• Include climate justice and coastal resilience actions in terms of policies and response strategies at national and regional level. | A 7 Legal and policy advice |
| **Uncertainty** | • Local governments struggle to adapt to, for example, sea level rise because of difficulty reaching consensus and quantifying uncertainty (and availability) in data. | • Emphasize and prioritize local level, community-based or local adaptation actions. Despite uncertainty about the degree of impact, there will be impacts and therefore adaptation pathways at the local level offer a low-risk, low-cost starting point for long-term adaptation. | A 2 Obtain expert assistance |

| TOPIC | KEY FINDING | RECOMMENDATIONS | ACTIONS |
|---|---|---|---|
| **Polycentric governance** | • A polycentric approach involving multiple governing bodies should guide the NAP process. | • Create community-based adaptation committees that can guide the use of adaptation funds locally. | A 4 Leverage networks<br>A 5 Organize relationships<br>A 6 Stakeholder action |
| **Best available science and data** | • Coastal and ocean adaptation planning should be based on the best available data. | • Specific improvements can be made to increase the use of climate and Earth observation services (e.g., GEO and Copernicus open data) in adaptation planning and implementation, e.g., refer to the IPCC assessment report series, the IOC/United Nations Educational, Scientific and Cultural Organization (UNESCO) State of the Ocean Report, the Copernicus Ocean State Report, the World Meteorological Organization (WMO) and other national and international organizations. | A 2 Obtain expert assistance<br>A 3 Data and information<br>A 8 Develop information infrastructure<br>A 9 UN4NAPS |
| **Regional adaptation support** | • Interdisciplinary and multinational efforts at a regional scale can develop quick, participatory methods to assess coastal communities' vulnerability and aid climate change adaptation. | • Regional coordination of adaptation support and knowledge should be enhanced (e.g., United Nations Regional Seas programmes, the South Pacific Regional Environment Programme and the West African Science Service Centre on Climate Change). | A 4 Leverage networks<br>A 10 Technical and scientific diplomacy |
| **Adaptation platforms** | • It is crucial to invest time and money and access decision-support resources like adaptation platforms. These tools help practitioners adapt and build long-term capacity to meet current and future needs. | • Develop information platforms to support NAP development through all four phases. Platforms should also support organizations and institutions across scale (e.g., Brazil: AdaptaClima). | A 2 Obtain expert assistance<br>A 8 Develop information infrastructure<br>A 9 UN4NAPS |

Source: The full literature review is available from Celliers *et al.* (2025).

PILLAR 3

# 3 Desktop review

This pillar presents the lessons learned from analysing the inclusion of coasts and oceans in existing NAPs (Celliers *et al.*, 2025).

**Table 3. Learnings from a desktop review and analysis of 30 published National Adaptation Plans spanning six regions**

| TOPIC | KEY FINDING | RECOMMENDATIONS | ACTIONS |
|---|---|---|---|
| **Coast and ocean policy** | • There is substantial regional variation in the inclusion of coasts or coastal sectors in published NAPs. | • Countries should include coasts and oceans as elements of NAPs or publish specific coastal and/or ocean NAPs. | A 12 Policy decision |
| **Coastal contexts** | • Most published NAPs largely neglect the coast as a geographic space or resource. | • Build on the recognition of coasts and oceans in existing legislation or policy instruments.<br>• Create awareness of the benefits of healthy oceans and coasts to the Blue Economy.<br>• Resulting adaptation actions in NAPs are based on the economic benefits of a sustainable Blue Economy and the achievement of the SDGs. | A 12 Policy decision |
| **Existing policies** | • The planning and implementation stages of the published NAPs demonstrate a limited engagement with existing national coastal or ocean policy. | • The NAP development process should consider existing coastal and ocean management mechanisms and institutions rather than building up adaptation strategies from zero.<br>• Institutions legally responsible for implementing these mechanisms automatically become stakeholders in the NAP development and implementation process.<br>• Emphasis should be given to strengthening the capacity of existing institutions. | A 7 Legal and policy advice |
| **Capacity** | • Many published NAPs do not identify capacity gaps to a sufficient degree of detail. | • Develop an understanding of human capacity and other technical support and infrastructure.<br>• Map the actions required to improve capacity to plan and implement adaptation across sectors, scales and levels of administration.<br>• Human capacity can be located within and outside of government.<br>• Engage with the UNFCCC and other United Nations bodies where critical capacity is lacking. | A 11 Capacity assessment and development |

| TOPIC | KEY FINDING | RECOMMENDATIONS | ACTIONS |
|---|---|---|---|
| **Climate data and information** | • Most published NAPs do not use context-specific climate data.<br>• Many NAPs rely on IPCC regional report data and do not scale down to country level or identify ways to make the information specific to the country. | • Explore and find the best available climate change data including observation and modelling data for NAP development and implementation.<br>• IPCC, IOC/UNESCO, WMO, GEO, Copernicus and other national and international organizations support the development of information services from Earth observations and climate modelling (climate services). Examples of context-specific models can be seen in the NAPs of Kuwait, Fiji and Timor-Leste.<br>• GEO could collaborate with the World Climate Research Programme Coupled Model Intercomparison Project climate projection and Coordinated Regional Climate Downscaling Experiment (CORDEX) programmes to integrate Earth observation with country level climate projection. | A 2 Obtain expert assistance<br>A 8 Develop information infrastructure<br>A 9 UN4NAPS |
| **Broad sectoral inclusion** | • Where the coast is included in NAPs, there is a focus on the economic sectors of fisheries and tourism.<br>• Most published NAPs use generic language for coasts or coastal sectors. | • Countries should consider all sectors of the Blue Economy included in ICZM, MSP policy and management plans.<br>• Priority adaptation actions are based on the importance of each sector to social well-being, GDP, ecosystem function, etc.<br>• Actions in NAPs should focus on supporting activities already managed by ICZM or MSP policy, or important sectors of the Blue Economy, where they are available. | A 12 Policy decision |
| **Local and Indigenous knowledge** | • The inclusion of local and Indigenous knowledge in published NAPs is limited. | • Forming community-based adaptation committees can guide the use of adaptation funds locally.<br>• Recognize and include local and Indigenous knowledge alongside other knowledge types. | A 4 Leverage networks<br>A 5 Organize relationships<br>A 6 Stakeholder action |

| TOPIC | KEY FINDING | RECOMMENDATIONS | ACTIONS |
|---|---|---|---|
| **Stakeholder awareness and engagement** | • Generally, stakeholder awareness and engagement are limited in published NAPs.<br>• The responsibility (for implementation, M&E) of recognized stakeholders lacks detail in most NAPs analysed. | • Civil society, communities and other local actors are facing the brunt of climate change impacts and are also on the forefront of climate adaptation. Accordingly, they should also be primary stakeholders in the cross-sectoral, multiscale and multilevel NAP planning process. Recognizing localized problem-solving is crucial, as is including multilevel (local, national, regional and international) institutions.<br>• Recognize impacts across scales and plan actions between many actors – some that operate at different scales and levels of administration. | A 4 Leverage networks<br>A 5 Organize relationships<br>A 6 Stakeholder action |
| **Climate hazards and disasters** | • Most NAPs that have coastal elements only consider a few common hazards which are currently of concern. | Countries should:<br>• Integrate NAP and DRR planning alongside implementation of EW4All (https://earlywarningsforall.org/site/early-warnings-all) a United Nations initiative for the inclusion of climate change hazards in adaptation planning.<br>• Use climate services to understand and adapt to projected regional climate change induced disaster risks that can pose future threats, including slow onset changes and extreme events. | A 2 Obtain expert assistance<br>A 8 Develop information infrastructure |
| **Regional adaptation coordination** | • NAPs lack strategies for regional adaptation efforts.<br>• Countries share coastal areas and should have regional adaptation strategies and regional coordination bodies. | • Countries should engage with regional adaptation support and knowledge, e.g., United Nations Regional Seas Programmes, the South Pacific Regional Environment Programme and West African Science Service Centre on Climate Change.<br>• NAPs should clearly define timelines and goals and mechanisms to evaluate progress. | A 4 Leverage networks<br>A 10 Technical and scientific diplomacy |
| **Implementation timelines** | • There is a general lack of timelines for implementation or M&E in published NAPs. | • NAPs should clearly define timelines and goals and mechanisms to evaluate progress. | A 16 Plan and track NAP process |

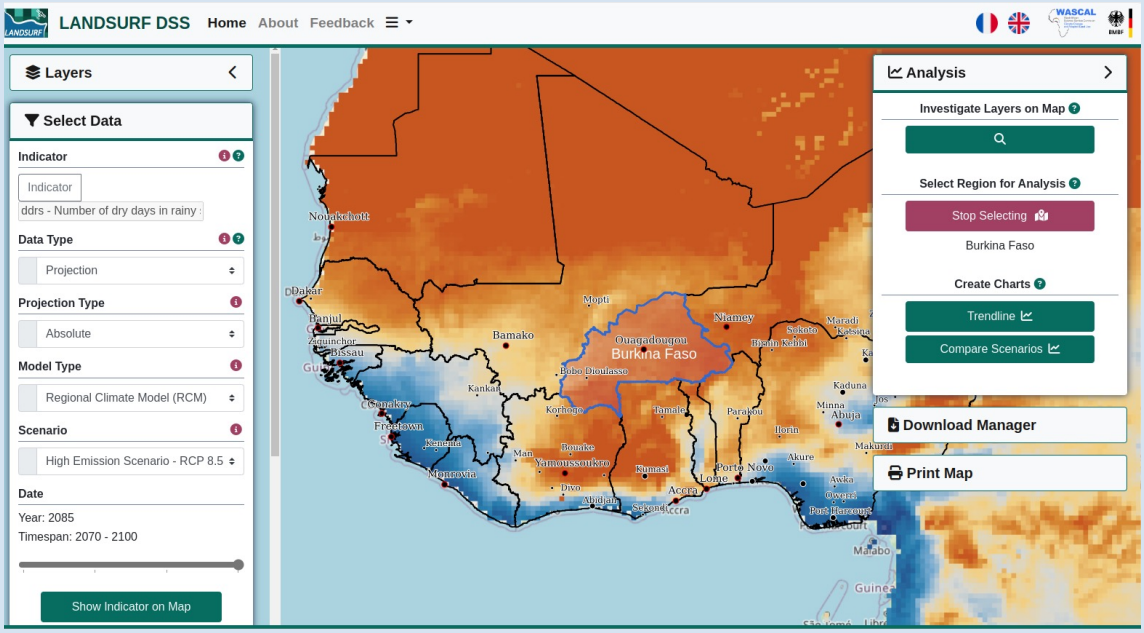
*Source*: Celliers *et al.*, 2025

# LANDSURF Decision Support System

*By Torsten Weber (GERICS)*

ARTICLE

**The Decision Support System (DSS) is a freely accessible web-based tool that delivers relevant climate change information with a focus on the agricultural sector, to West African stakeholders for climate change adaptation (https://landsurf.geo.uni-halle.de).**




**The LANDSURF Decision-support Tool (DSS) https://landsurf.geo.uni-halle.de**

It allows users to analyse critical climate and land use indicators that support risk management in the agricultural sector and can also be used by stakeholders in other sectors who need information on extreme precipitation and temperature events (Ziegler *et al.*, 2025, https://www.sciencedirect.com/science/article/pii/S2405880725000469?via%3Dihub).

Specific climate indicators are presented through spatial maps and spatially averaged trends to support stakeholders and smallholder farmers in their decision-making processes. The indicators provided by the portal are derived from Coupled Model Intercomparison Project 5 global climate projections, CORDEX-CORE Africa regional climate projections for two different emission scenarios (RCP2.6 and RCP8.5) and observational datasets. The DSS portal and the content were developed and co-designed in an interactive process with stakeholders from the region in the West African Science Service Centre on Climate Change and Adapted Land Use WRAP 2.0 LANDSURF project funded by the German Federal Ministry of Education and Research.

# 4 PILLAR 4 Supplementary material

This pillar is a quick reference guide to supplementary material in the UNFCCC NAP central library that could be useful for planning coastal and ocean adaptation.

**Table 4. Supplementary material in the United Nations Framework Convention on Climate Change National Adaptation Plan central library can be very useful for including coastal and ocean adaptation in the National Adaptation Plan development process**

REFER TO PG. 66

| TOPIC | SUPPLEMENTARY MATERIAL | NAP DEVELOPMENT STAGE | OBJECTIVES | RELEVANCE TO COASTAL ADAPTATION |
|---|---|---|---|---|
| **Disaster and climate adaptation** | **United Nations Office for Disaster Risk Reduction. 2021.** Promoting synergy and alignment between climate change adaptation and disaster risk reduction in the context of National Adaptation Plans: A supplement to the UNFCCC NAP Technical Guidelines. **High relevance** | Assessing risk and planning | Provides practical recommendations on how to strengthen and better promote synergy and coherence between adaptation and DRR. | The relationship between DRR and NAPs is important for coastal areas and especially relevant for the NAP development process. |
| **Ecosystem adaptation** | **Conservation International. 2015.** Tool for integration of ecosystems into climate change adaptation planning processes. **High relevance** | Assessing risk and planning | Facilitates an efficient process for considering ecosystems in the NAP planning process. | Supports the inclusion of coastal and ocean ecosystems in NAPs. |
| **Forestry and fisheries adaptation** | **Food and Agriculture Organization of the United Nations. 2017.** Addressing agriculture, forestry and fisheries in National Adaptation Plans. **Medium relevance** | All | Aims to support a) national planners and decision-makers working on climate change in developing countries to better understand the need and opportunities for adaptation in agriculture, forestry and fisheries; and b) authorities and experts within the agricultural sectors who are already contributing to climate change adaptation and NAP formulation. | Includes fisheries |
| **Urban and human settlements** | **United Nations Human Settlements Programme. 2019.** Addressing urban and human settlements issues in National Adaptation Plans. **High relevance** | Assessing risk and planning; implementation | Addresses urban and human settlement at the formulation and implementation stage of NAPs. | Urban and human settlements on the coasts are very susceptible to climate change impacts. |
| **Water adaptation** | **Global Water Partnership. 2019.** Addressing water in National Adaptation Plans: Water supplement to the UNFCCC NAP Technical Guidelines. Second edition. **Medium relevance** | All | Supports developing countries to incorporate water-related adaptation needs and opportunities in the formulation and implementation of NAPs. | The water sector is as relevant for the coast as it is for any urban and rural area. |

| TOPIC | SUPPLEMENTARY MATERIAL | NAP DEVELOPMENT STAGE | OBJECTIVES | RELEVANCE TO COASTAL ADAPTATION |
|---|---|---|---|---|
| **Fisheries and aquaculture adaptation** | **Brugere, C. & De Young, C. 2020.** Addressing fisheries and aquaculture in National Adaptation Plans. Supplement to the UNFCCC NAP Technical Guidelines. **Very high relevance** | All | Supports adaptation planning within the fisheries and aquaculture sector. | Specific requirements for including the fisheries and aquaculture sector in NAPs. |
| **Coastal forest and mangrove adaptation** | **Meybeck, A., Gitz, V., Wolf, J. & Wong, T. 2020.** Addressing forestry and agroforestry in National Adaptation Plans: Supplementary guidelines. **High relevance** | Assessment and risk | Addresses the needs of forestry and agroforestry for adaptation and their potential to support the adaptation of other sectors, subsectors and activities. | Specific reference to coastal forests and mangroves. |
| **Biodiversity and climate change adaptation** | **Convention on Biological Diversity. 2014.** Promoting synergies in addressing biodiversity and climate change adaptation issues: linking National Adaptation Plans and national biodiversity strategies and action plans. **High relevance** | Assessment and risk | Assists national focal points of the Convention on Biological Diversity to collaborate with their UNFCCC counterparts to strengthen synergies between the conservation and sustainable use of biodiversity and climate change adaptation at the national level. | Coastal and ocean biodiversity protection is a global and national priority. Refers to the impact of climate change on coasts. |
| **Ecosystem-based adaptation** | **United Nations Environment Programme. 2021.** Guidelines for integrating ecosystem-based adaptation into National Adaptation Plans: Supplement to the UNFCCC NAP Technical Guidelines. **High relevance** | Assessment, risk, and planning | Guides and motivates countries to adopt ecosystem-based approaches to adaptation. | EbA is an important element of MSP and other ocean and coastal management instruments. |

LDCs and SIDS are specifically referred to in the ***Technical guide on sea level rise*** provided by the Warsaw International Mechanism for Loss and Damage and published by the UNFCCC. This publication aims to establish a common understanding of how to systemically manage the impacts and anticipate the risks of slow onset sea level rise.

The OECD synthesizes ocean-related datasets and provides information on ocean topics such as resilience in coastal communities and policy responses directed at ocean sustainability. The database integrates valuable ocean-related datasets to support global efforts in conserving and sustainably managing the oceans. This includes key ocean-related indicators for coastal adaptation, including coastal flooding hazard and exposure, coastal land cover change and coastal adaptation interventions. To read key messages and the description of the indicators, please see the ***Environment at a glance indicators web-book***.

# Population exposed to compound climate extremes along the African coast

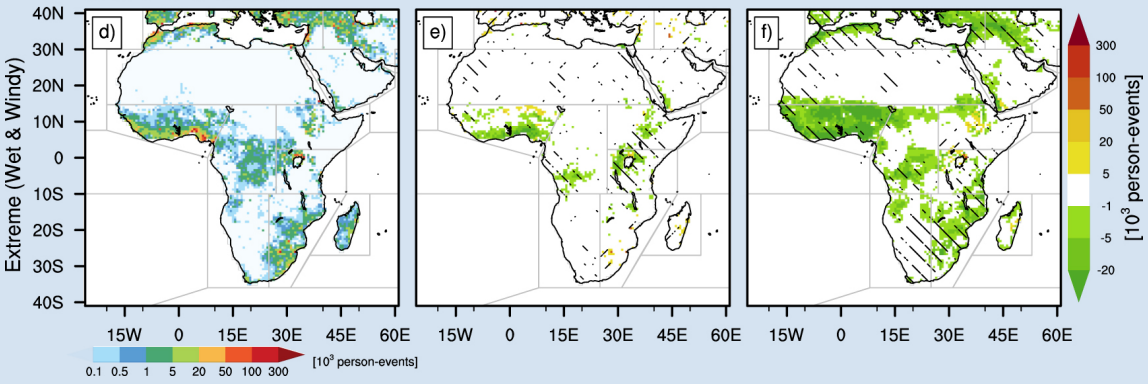
ARTICLE

*By Torsten Weber (GERICS)*

**By the end of the century, Africa's coastal regions are expected to experience noticeable population growth, although the rate of growth differs between the two Shared Socioeconomic Pathways (SSPs) 1 and 3 from the Socioeconomic Data and Applications Centre (SEDAC) population projections (Weber *et al.*, 2020).**

For the same period, regional climate projections from the CORDEX-CORE Africa ensemble project a change in the frequency of compound climate extremes in the Representative Concentration Pathways (RCPs) 2.6 and 8.5 for different parts of Africa. By combining information on population change with changes in the frequency of compound climate extremes, it is possible to identify the coastal regions in Africa where population exposure will decrease or increase in the future.

For instance, projections under the RCP8.5/SSP3 scenario show that the exposure of the population to coincident extreme wet and windy events will decrease on the Algerian and Moroccan coast, west and southeast African coast, and Madagascar (Tamoffo *et al.*, 2025). Conversely, population exposure to coincident heat waves and droughts and coincident hot and humid events is projected to increase under the RCP8.5/SSP3 scenario on the west and east African coast, the Angolan coast and Madagascar by the end of the century (Weber *et al.*, 2020; Tamoffo *et al.*, 2025).




**Annual climatology (1981–2010) of population exposure to coinciding extreme wet and windy events**

***Notes:*** Annual climatology (1981–2010) of population exposure (in-person events) to coincident extreme wet and windy events (a) from the European Centre for Medium-Range Weather Forecasts Re-analysis 5 dataset and from the Inter-Sectoral Impact Model Intercomparison Project2b population dataset. Projected total changes in population exposure to coincident extreme wet and windy events as an ensemble mean from CORDEX-CORE Africa regional climate projections and from SEDAC population projections (2069–2098) under (b) RCP2.6/SSP1 and (c) RCP8.5/SSP3. Positively sloped hatching highlights areas where 66 percent, or six out of nine simulations, predict positive signals of change, while negatively sloped hatching highlights areas where 66 percent, or six out of nine simulations, predict negative signals of change (Tamoffo *et al.*, 2025).

Sources: **Tamoffo *et al.***, 2025, https://doi.org/10.1088/1748-9326/ad9d5f; Weber *et al.*, 2020, https://doi.org/10.1029/2019EF001473

# Inundation and coastal flooding

*By Lisa Rebello (Digital Earth Africa)*

ARTICLE

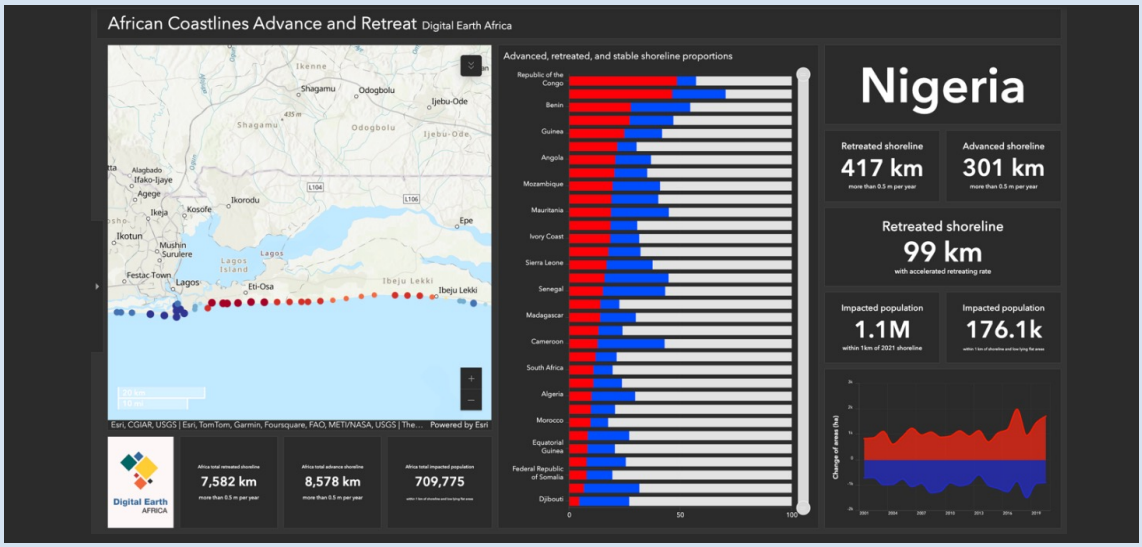
**Rising sea levels combined with more frequent storm surges are causing coastal flooding and erosion. This results in the loss of coastal habitats that provide natural shoreline protection, placing increasing populations at risk. While the impacts of sea level rise are generally limited to relatively small areas, across the African continent those small areas are home to some of the largest cities (ACM, 2024).**

Understanding where coastlines are eroding and populations are at risk is critical in informing local adaptation needs. To address coastal erosion effectively, technologies such as Earth observation and geographic information systems can play a crucial role, providing invaluable data on coastal dynamics about people and settlements and enabling informed decision-making for sustainable coastal management.

Cloud-based platforms like Digital Earth Africa enable continuous monitoring of coastal changes, offering insights into erosion trends and supporting proactive interventions. Using the publicly available tools offered by Digital Earth Africa, stakeholders can monitor these changes and evaluate the impact of coastal management, as well as responses to changing conditions such as extreme weather events and human development.


Digital Earth Africa Coastlines Monitoring – 24 years of coastline change, Lagos, Nigeria

**To support national adaptation planning, these data are analysed and provided by Digital Earth Africa as a summary dashboard for all 38 coastal African countries.**




**Digital Earth Africa Coastlines Monitoring – annual change and impact statistics, Nigeria**

Source: https://digitalearthafrica.org/en_za/coastlines

# 5 PILLAR 5 Stakeholder engagement

This pillar summarizes the views, comments and suggestions of stakeholders from LDCs, SIDS and the public and private sectors on what to consider when including coastal and ocean adaptation requirements in NAPs.

**Table 5. Comments and suggestions on stakeholder engagement, as gathered from coastal and ocean stakeholders in five interactive workshops**

| TOPIC | STAKEHOLDER INPUT | RECOMMENDATIONS | ACTIONS |
|---|---|---|---|
| **Human capital development** | • Investment in human capital is needed to improve the inclusion of coastal and ocean adaptation in the NAP development process. | • Develop an understanding of human capacity and other technical support and infrastructure and map the actions to improve capacity and plan adaptation across sectors, scales and levels of administration.<br>• Human capacity can be located within and outside of government.<br>• Engage with the UNFCCC where critical capacity is lacking. | A 11 Capacity assessment and development<br>A 9 UN4NAPS |
| **Findable, accessible, interoperable and re-usable (FAIR) data and information** | • Improve data coverage and availability.<br>• Improve data sharing and policies. | • Explore and find the best available climate change, observation and other data for NAP development and implementation, including from the IPCC Assessment Report series, WMO, GEO and other national and international organizations.<br>• Improve sharing of data within countries, between countries and at a regional level. | A 2 Obtain expert assistance<br>A 8 Develop information infrastructure<br>A 9 UN4NAPS |
| **Information services** | • Develop customized Earth observation and climate services to support the inclusion of coasts in NAPs. | • Develop climate and observation services provided to information platforms to support NAP development through all four phases.<br>• Platforms should also support organizations and institutions across scale. | A 2 Obtain expert assistance<br>A 8 Develop information infrastructure<br>A 9 UN4NAPS |
| **Improve coast and ocean policies** | • Improve legal and policy frameworks and develop NAPs aligned with existing coastal and ocean management tools. | • NAP development processes should consider the existing coastal and ocean management mechanisms and institutions.<br>• In many instances, there are gaps in policies that must be filled over time. These should be considered for their existing and potential contribution to climate change adaptation.<br>• Institutions legally responsible for implementing these mechanisms automatically become stakeholders in the NAP development and implementation process. | A 7 Legal and policy advice |

| TOPIC | STAKEHOLDER INPUT | RECOMMENDATIONS | ACTIONS |
|---|---|---|---|
| **Local and Indigenous knowledge** | • Improve the recognition and use of Indigenous and local knowledge. | • Forming community-based adaptation committees can guide the use of adaptation funds locally.<br>• Recognize and include local and Indigenous knowledge alongside other knowledge types. | A 4 Leverage networks<br>A 5 Organize relationships<br>A 6 Stakeholder action |
| **Climate futures** | • Include future conditions (e.g., climate change projections, shared socioeconomic pathways) in NAPs. | • Consider NAP development processes that include current and future decision-making contexts, i.e. immediate actions to reduce risks and vulnerabilities and staggered or scheduled actions in the medium and long terms. | A 2 Obtain expert assistance<br>A 3 Data and information<br>A 1 Risks |
| **Multisectoral, multilevel collaboration** | • Establish effective collaboration across sectors and regions. | • Countries should consider all sectors of the Blue Economy included in ICZM, MSP policy and management plans.<br>• Priority adaptation actions are based on the importance of each sector to well-being, GDP, etc.<br>• Actions in NAPs should focus on supporting activities already managed by ICZM or MSP policy, or important sectors of the Blue Economy.<br>• There are substantial opportunities for countries to engage with regional coordination of adaptation support and knowledge. | A 4 Leverage networks<br>A 10 Technical and scientific diplomacy<br>A 12 Policy decision |
| **Finance for adaptation** | • Increase funding to support research and adaptation actions. | • Funding for the development of NAPs is often available, but sustained funding for adaptation is not.<br>• An appropriate and relevant mix of adaptation options at the correct scale may be useful to distribute the cost so that it becomes self-sustaining.<br>• Funding of adaptation is a shared responsibility between government, the private sector and civil society. | A 17 NAP and adaptation funding |
| **Monitoring and evaluation** | • Improve legal and policy frameworks and develop NAPs aligned with existing coastal and ocean management tools. | • Countries could form multi-agency, multilevel teams to address M&E of the NAP process, including financing of actions. | A 4 Leverage networks<br>A 5 Organize relationships<br>A 14 Monitoring and evaluation |

Source: Celliers *et al.* (2025).

PILLAR 6

# 6 Climate and Earth observation services

**This pillar presents information on how to incorporate climate and Earth observation services when planning the inclusion of coastal and ocean adaptation requirements in NAPs.**

Tables 6 and 7 provide key outputs that could rely on climate services and Earth observation to better include coastal and ocean adaptation requirements in the development of NAPs.

A23

## The role of climate services in support of National Adaptation Plans

REFER TO PG. 67

Climate services are tools and products that turn climate data and related information into useful resources for society. These can include forecasts, projections, trends, economic and technological assessments, advice on best practices and solutions for dealing with climate impacts. Their goal is to help with climate adaptation, emissions reduction and the management of disaster risks.

Coastal climate services provide climate-related information for coastal areas to support adaptation decisions. These services may include projections of ocean-related impacts such as sea level rise, coastal storms, flooding, changes in water temperature and extreme weather. They also cover climate indicators that affect nearby land areas (the "dry coast"), such as extreme heat, strong winds and heavy rainfall, which impact coastal communities.

Table 6 presents more details on the ways in which climate services may support adaptation.

Island of Haiti,
© Unsplash

REFER TO PG. 67

| USE OF CLIMATE SERVICES | WHEN? | HOW? | EXAMPLE |
|---|---|---|---|
| **Hazard assessments for use in vulnerability and risk assessments** | Evaluated during the initial phase of the NAP process | The provision of historical climate data, hazard profiles, weather forecasts and projections of climate change impacts enable LDCs and SIDS to identify the most at-risk sectors, regions and communities. To assess risk, it is important to identify and map key hazards and the exposure of vulnerable people, critical infrastructure, economic activities and ecosystems. | Hydro-meteorological seasonal forecasts, re-analysis or long-term projections can assist in the identification of coastal regions susceptible to floods, droughts or heatwaves, thereby enabling governments to prioritize areas for early intervention. |
| **Evidence-based decision-making and planning** | During the formulation and design phase of NAPs | Climate services support evidence-based planning by offering downscaled climate projections and scenario analysis. This enables LDCs and SIDS to design sector-specific strategies for agriculture, fisheries, water resources, health and infrastructure. | Climate services help to identify patterns of fish migration related to projected changes in temperature and rainfall, supporting climate-smart fisheries. |
| **Early warning systems and preparedness** | During the monitoring and implementation stages of NAPs | Early warning systems enhance preparedness for extreme weather events and facilitate the ability of governments and communities to take early action. | Coastal areas vulnerable to cyclones can be provided with timely warnings, thereby reducing the loss of human life and economic damage. |
| **Monitoring, evaluation and learning** | Should be included in all stages of NAP development and implementation | Climate services can support monitoring, evaluation and learning with customized climate information for coastal areas. | Combining in situ meteorological observations, climate services and Earth observation data enables the monitoring of alterations in coastal flood-prone regions, facilitating the evaluation of the efficacy of flood control strategies and the potential for modifications to NAPs. |
| **Financing and investment** | Resource mobilization phase of the NAPs | The best available customized climate information can help LDCs and SIDS justify the need for adaptation financing. | When applying to the Green Climate Fund or other financial mechanisms. |

# Copernicus services

*By Mercator Ocean International*

ARTICLE

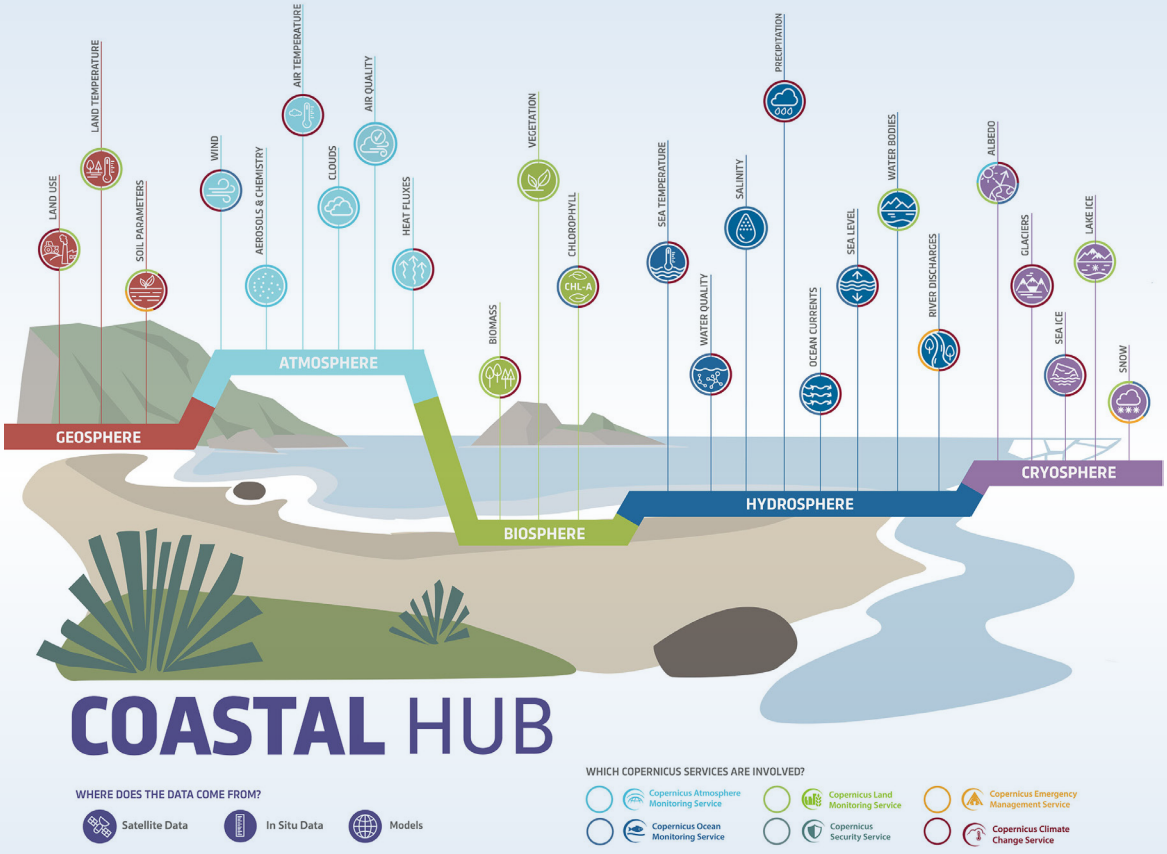
**The European Union's Earth observation programme Copernicus integrates satellite, in-situ and modelling data to provide free, accessible services for monitoring the planet and environment. It delivers near-real-time and historical datasets for applications like urban management, agriculture, disaster response, MSP and climate monitoring. Policymakers and organizations use Copernicus to inform decisions, develop policies and create tailored value-added services, fostering sustainability and innovation.**

One of six Copernicus services, Copernicus Marine Service delivers daily historical and forecasting information on ocean dynamics and ecosystems for global and European seas. It provides key inputs that support major policies and initiatives contributing to combating pollution, marine protection, maritime activities, climate monitoring and more.

This global service provides free, open and immediate access to scientifically validated and regularly updated information on the physical and biogeochemical state of the global ocean.

Key offerings supporting policy and decision-making include:

- Ocean observation and model products (including currents, temperature, wind, wave, salinity, sea level, sea ice and biogeochemistry)
- Annual ocean state reports
- Ocean monitoring indicators
- Visualization tools




Another service of the Copernicus programme is the Copernicus Coastal Hub. It offers open and free Earth observation data focused on coastal zones, encompassing air, sea and land products from the different Copernicus services. This data provides insights into the coastal environment and the intricate land–sea continuum through a wide range of variables. Only focused on the European coasts at this stage, it provides the first land-to-sea coastal approach to data and service providing.

## The role of Earth observations in support of National Adaptation Plans

A22

REFER TO PG. 67

Earth observation technologies play a crucial role in data and insights for coastal and ocean NAPs throughout the NAP process by improving risk assessment, monitoring the progress of NAP implementation, forecasting climate change impacts and guiding course-correcting decision-making. Key contributions include:

- **In situ observations** such as tide gauges, drifting and fixed buoys and manned surveys provide real-time, localized data. Integrating in situ measurements with remote sensing data enhances the accuracy and reliability of coastal monitoring systems.
- **Satellite remote sensing** offers large-scale, high-resolution imagery of the world's coastal zones. For example, Copernicus Sentinel-3 satellites measure sea surface topography, sea and land surface temperature and ocean and land surface colour with exceptional precision, supporting climate and environmental assessments. Similarly, other satellite missions offer data on coral bleaching, ocean colour, ocean heat content, sea surface temperature and many other ocean variables.
- **Global navigation satellite systems** such as global positioning systems and the Terrestrial Reference Frame provide essential information to anticipate future sea level rise, especially for SIDS to understand the changes in an islands coastline and elevation.
- **Airborne sensors** provide high-resolution, site-specific data essential for mapping coastal elevations and underwater features, aiding in hazard assessment and resilience planning.

Coupled ocean modelling can support coastal management by simulating tides, currents, sea level rise and other coastal dynamics. These models, informed by Earth observation data, help predict hazards such as flooding, erosion and storm surges, contributing to early warning systems and sustainable coastal planning.

By combining Earth observation with ocean models, operational oceanography can provide Earth intelligence with an estimate of the state of the ocean for the past, present and the future at any location. These monitoring, re-analysis and forecast products are provided by services such as the Copernicus Marine Environment Monitoring Service. The integration of digital technologies such as artificial intelligence and machine learning with Earth observation's big data, enhances coastal monitoring and data-driven decision-making, offering powerful tools for national adaptation planning.



Analysis-ready data, which is often disseminated in the form of a "data cube", allows for immediate analysis and ensures interoperability with other data sets. They lower barriers for people with skills in global information systems to avoid spending considerable time and effort on data preparation. Instead, efforts can be allocated to integrate and analyse the growing volume of satellite data for context-specific needs and locations. For instance, Digital Earth Africa (https://digitalearthafrica.org/en_za/) assessed the location and patterns of coastal retreat and erosion for a seaside resort in Senegal. Moreover, the public agency Ports of Spain integrates data from observation platforms and high-resolution modelling and developed visualisation tools to enable localized climate risk assessments across 46 major ports.

Strengthening capacity-sharing efforts by training and equipping local stakeholders in Earth observation applications is essential for effective coastal management and climate resilience.

# Other considerations

Supporting the six pillars are **five other considerations** that may be useful for LDCs planning coastal and ocean adaptation within NAPs. These include economic sectors to consider when including i) coastal and ocean adaptation requirements in the development of a NAP; ii) adaptation strategies that may be considered for inclusion; iii) indicators of the effectiveness of coastal and ocean adaptation; iv) potential nature-based solutions (NbS) to support coastal and ocean adaptation; and v) UN4NAPs (a United Nations-wide rapid technical backstopping initiative for NAPs).

## Economic sectors to consider when including coastal and ocean adaptation requirements in the development of a NAP

A12

**Policy decision**

REFER TO PG. 65

When developing a NAP with a focus on coastal and ocean adaptation, it is essential to consider a wide range of economic sectors that are directly or indirectly affected by climate change impacts on marine and coastal systems. The key sectors to include are shown in Table 8.

A18

**Cross-sectoral adaptation**

REFER TO PG. 66

**Table 8. A list of economic sectors to consider when including coastal and ocean adaptation requirements in the development of a National Adaptation Plan**

| TYPES OF ECOSYSTEM SERVICES | ECONOMIC SECTORS | COASTAL | OCEAN |
|---|---|---|---|
| **Harvesting of living aquatic resources** | • Commercial and artisanal fishing (inland, coastal and deep-sea) | √ | √ |
| | • Processing of fish products | √ | √ |
| | • Aquaculture | √ | √ |
| | • Mariculture (including seaweeds) | | √ |
| | • Pharmaceuticals, chemicals, cosmetics, genetic research | | √ |
| **Extraction of non-living resources and generation of energy** | • Deep-sea and seabed mining | | √ |
| | • Offshore oil and gas | | √ |
| | • Renewable energies | √ | √ |
| | • Marine salt harvesting | √ | |
| | • Coastal mining of sand, gravel and other construction materials | √ | |
| | • Desalination plants | | |
| **Commerce and trade in and around oceans and rivers** | • Maritime transport and logistic services | √ | √ |
| | • Port infrastructure | √ | |
| | • Shipbuilding and repairs | √ | |
| | • Equipment and machinery | √ | |
| | • River transport | √ | √ |
| | • Tourism and recreation | √ | √ |
| | • Commercial fishing | √ | |
| **Commerce and trade in and around the coast** | • Agriculture | √ | |
| | • Forestry (coastal and mangroves) | √ | |
| | • Fish and wildlife management | √ | √ |
| | • Parks and recreation | √ | √ |
| | • Education | √ | √ |
| | • Public health | √ | √ |
| | • Urban development, transportation and settlements | √ | |
| | • Water management | √ | |
| | • Transportation | √ | |
| | • Flood control | √ | √ |
| | • Industrial development | √ | |
| | • Tourism and recreation | √ | |
| **Protection** | • Coastal protection | √ | √ |
| | • Marine ecosystem protection | √ | |
| | • Water resource protection | √ | |
| **Cultural and religious values** | • Cultural and religious practices | √ | √ |
| | • Sport | | |
| | • Recreation | | |
| **Knowledge and information** | • Biophysical, socioeconomic and political research | √ | √ |

# Coastline erosion

*By Lisa Rebello (Digital Earth Africa)*

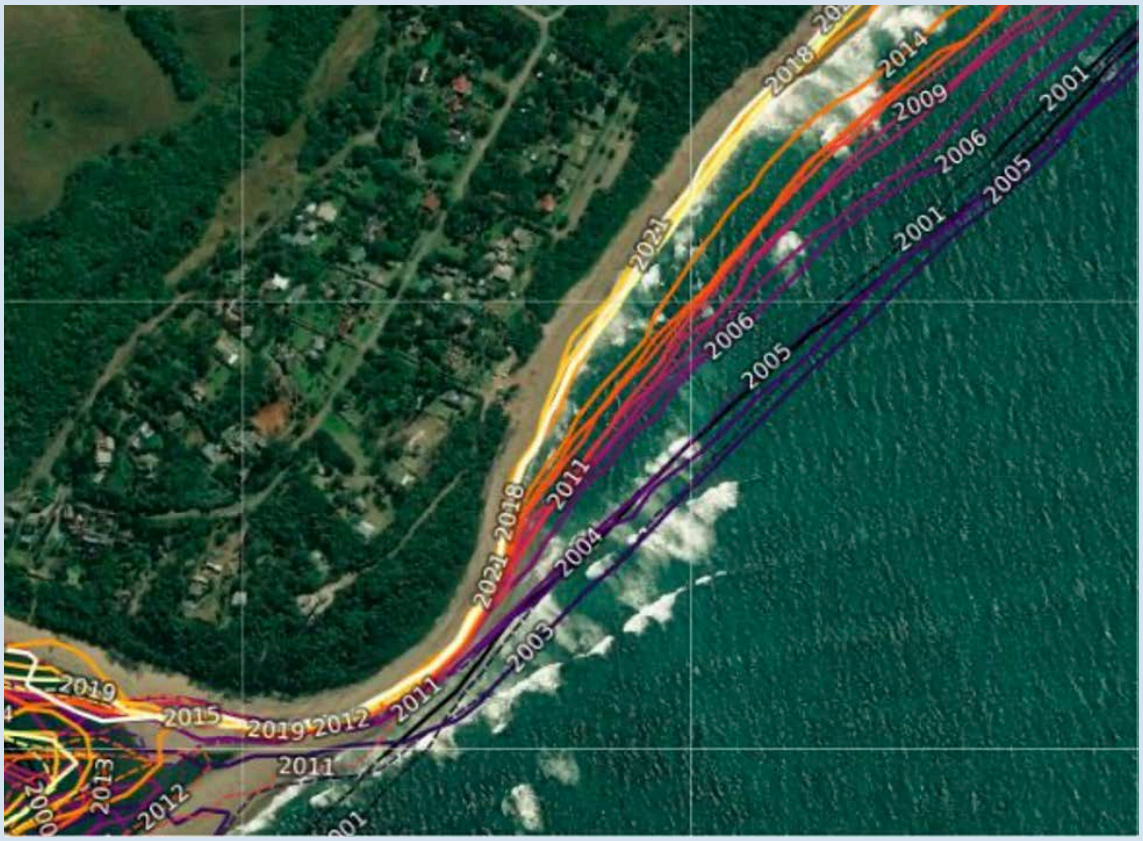
ARTICLE

**South Africa's 2,798 km coastline faces escalating risks from climate change and environmental degradation. Coastal erosion is a persistent challenge, arising from natural forces like wave energy and climate change-induced sea level rise, compounded by human activities such as urbanization and sand mining. Coastal areas are increasingly vulnerable to erosion, with far-reaching environmental, health and socioeconomic impacts.**

Satellite Earth observations offer critical solutions for monitoring and managing these risks. Cloud-based platforms such as Digital Earth Africa provide continuous data on coastal dynamics, enabling informed decision-making for sustainable management. The South African Environmental Observation Network emphasizes the value of these tools in addressing coastal risks in South Africa (https://sarva.saeon.ac.za/coastal-vulnerability).

Digital Earth Africa's Coastline Monitoring Service documents annual changes since 2000, indicating that the coastline near the Tugela River mouth has retreated inland by 14 m (approximately 1.5 m per year) since 2000. This shoreline was the most seaward in 2003 and the most landward in 2020. Since 2000, the median annual position of the shoreline has moved approximately 257 m and demonstrates a clear long-term pattern of coastal erosion, which, without proactive measures being implemented will devastate the local community and tourism in the area.

Source: https://digitalearthafrica.org




**Digital Earth Africa Coastlines Monitoring Service shows that the coastline near the Tugela River mouth in South Africa has retreated inland by 14 m since 2000**

Source: https://maps.digitalearth.africa/#share=s-sCTUTXQmMIPjqznIW1mDa70P8m5

## Adaptation strategies to be considered for inclusion

A21
Adaptation options
REFER TO PG. 67

When integrating coastal and ocean adaptation strategies into a NAP, it is important to consider a mix of engineering, ecosystem-based, institutional and community-based approaches. These strategies aim to reduce vulnerability, enhance resilience and ensure sustainable development in the face of climate change impacts such as sea level rise, ocean acidification and extreme weather events. A non-exhaustive list of adaptation strategies is shown in Table 9.

**Table 9. A non-exhaustive list of adaptation strategies for coastal and ocean systems with an assessment of their feasibility and effectiveness**

| CATEGORY | ADAPTATION STRATEGY | FEASIBILITY | EFFECTIVENESS |
|---|---|---|---|
| Social–institutional adaptation | **Knowledge diversity** recognizes the use of different types of knowledge (e.g., scientific and local knowledge) for effective adaptation. Local communities could be involved in the development of adaptation plans using scientific and participatory methods. This is a strategy that is relatively low-cost, can leverage local expertise and build trust in adaptation plans. It is key for culturally relevant solutions. | High | Low |
| | **Socially inclusive policies** are those based on equity and justice, participation and representation. They address the root causes of vulnerability, accessibility and affordability, recognition of rights and cultural sensibility. They are essential for equitable adaptation but come with a high initial cost. | High | Low |
| | **Participation** encourages institutionalized meaningful involvement, inclusivity, empowerment, co-creation and iterative societal engagement processes. Participation is based on principles such as transparency, accountability, respect, accessibility and relevance. It is critical for enabling local buy-in and long-term sustainability but comes with the challenges of logistics and coordination. | Medium | High |
| | **Livelihood diversification** is a strategy to reduce vulnerability by increasing the types of income sources, activities and assets that households and individuals rely on. It involves expanding sources of income, diversifying assets and reducing dependence. It directly addresses vulnerability and can be implemented at the household level with relatively low external investment. It has high local impact potential. | Low | Medium |
| | **Mobility** is a complex concept that recognizes that human movement, in its various forms, can be a response to climate change. This form of adaptation includes a range of human movements, for example, voluntary migration, displacement, planned relocation and accommodation. It has complex social and ethical challenges. For example, planned relocation is costly and can be disruptive, but migration can be distress-driven and worsen existing vulnerabilities. | Medium | Medium |
| | **Finance and market mechanisms** flow from various sources (public, private, domestic and international) to support climate-related activities. These adaptation options depend on financial mobilization, enabling conditions, cooperation and market mechanisms, among other things. These are heavily dependent on external funding and political stability. If they are well-designed and targeted they can be effective, but they are often impacted by corruption and leakage. | Medium | High |
| | **Disaster response programmes** are organized efforts to provide immediate assistance and support to people and communities affected by disasters. They are designed to save lives, alleviate suffering and protect property in the aftermath of a disaster. Disaster response programmes include search and rescue, emergency medical care, shelter, food and water, sanitation and communication and logistics. The main challenges include coordination access, funding and equity. Disaster response programmes are essential for immediate disaster relief but their effectiveness depends on preparedness and coordination. Recurring costs can be a strain on LDCs' budgets. | High | Low |

| CATEGORY | ADAPTATION STRATEGY | FEASIBILITY | EFFECTIVENESS |
|---|---|---|---|
| Social–institutional adaptation | **Multilevel ocean governance** refers to a system that involves the coordinated action of stakeholders at multiple levels, from local communities to national governments and international organizations. This form of governance recognizes that effective ocean management requires collaboration and cooperation across different scales and jurisdictions and includes key characteristics such as vertical and horizontal integration, stakeholder engagement, adaptive management and an ecosystem-based approach. It is important because of the complexity of ocean issues, overlapping jurisdictions and multiscale climate change impacts. Multilevel ocean governance is complex and difficult to implement, especially in countries with weak governance structures, but it is essential for long-term sustainable management. This form of governance often faces political and institutional barriers. | High | High |
| | **Institutional transboundary agreements** are formal agreements, treaties or conventions between two or more countries that establish institutions, rules and procedures for managing transboundary resources (e.g. migratory species) or for addressing shared climate change problems. They are politically challenging to negotiate and enforce and depend on the willingness of multiple countries to cooperate. | Low | High |
| Built infrastructure and technology | **Protection and nourishment**<br>Protection relies on hard engineering – building structures like seawalls and breakwaters – to create physical barriers against erosion, sea level rise and storm surges, safeguarding shorelines and infrastructure. Coastal protection has a high initial cost and may be environmentally damaging. Conversely, nourishment uses soft engineering, primarily sand replenishment, to restore eroded beaches. It aims to mimic natural processes and enhance coastal resilience in a more natural way. Coastal nourishment has lower initial costs but needs to be frequently redone and maintained. However, it is more environmentally friendly. | Medium | Medium |
| | **Early warning systems** are designed to generate and share timely, meaningful warning information, empowering individuals and communities to prepare for hazards and minimize harm. Key components include understanding risk through hazard and vulnerability assessment; monitoring and forecasting hazards using scientific tools; communicating clear warnings effectively; and ensuring preparedness for response. Effective early warning systems are people-centred, timely, accurate, understandable, accessible, actionable, multi-hazard, integrated and sustainable. They are relatively low-cost and highly effective at reducing disaster losses. They depend on community preparedness and clear communication channels. | High | High |
| | **Seasonal and dynamic forecasts** predict future climate conditions. Seasonal forecasts offer average climate expectations (e.g., temperature and precipitation) for three to six months, while dynamic forecasts use complex models to simulate climate processes, providing detailed predictions across various timescales. Forecasts provide valuable information for planning but require technical expertise and reliable infrastructure to interpret and disseminate. | High | High |
| | **Habitat development** is not a singular adaptation option but incorporates aspects of EbA, habitat restoration and green infrastructure, among others. Habitat development is a medium-cost strategy, is highly feasible and requires integration with coastal development planning. | Low | Low |
| | **Assisted evolution** is not a recommended mainstream adaptation solution but can be considered in specific, limited circumstances. It includes assisted migration and assisted adaptation and encompasses interventions aimed at enhancing the adaptive capacity of species in their existing habitat. This might involve selective breeding, gene flow enhancement and microbiome manipulation. It has a high initial cost, is experimental and may have potentially unpredictable and negative consequences. This is not a recommended strategy, but it comes at a low initial cost. | Medium | Medium |

| CATEGORY | ADAPTATION STRATEGY | FEASIBILITY | EFFECTIVENESS |
|---|---|---|---|
| Marine and coastal nature-based solutions | **Habitat restoration** is a key implementation strategy embedded within broader EbA adaptation approaches, for example coastal habitat restoration and wetland restoration. It offers multiple benefits, such as coastal protection and improved fisheries and carbon sequestration and relies on community involvement. | Medium | High |
| | **MPAs and other effective area-based conservation measures** are important tools for both climate change adaptation and mitigation, primarily through their contribution to biodiversity conservation and ecosystem services. These include biodiversity conservation, ecosystem services provision and climate adaptation and mitigation. MPAs require strong governance and enforcement. They could provide long-term benefits for biodiversity and fisheries but may displace local communities if not implemented carefully. | High | Medium |
| | **Climate refugia** are areas that experience slower rates of climate change or maintain relatively stable microclimates, allowing species to persist in otherwise inhospitable regions. Conservation of these areas can provide havens for species struggling to adapt to changing conditions. They require scientific assessment to identify and can be effective for protecting specific species but may not address broader ecosystem-level challenges. | Medium | High |
| | **Transboundary MSP and ICZM**<br>MSP is a process for analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives. Transboundary MSP extends this process across national or regional borders. This option may be politically challenging to implement but is essential for managing shared resources and transboundary impacts. | High | High |
| | **Sustainable harvesting** refers to managing the extraction of natural resources (e.g., timber, fish and crops) in a way that ensures their long-term availability and maintains the health and resilience of the ecosystems from which they are derived. This means harvesting resources at a rate that does not exceed their capacity for regeneration or recovery. It offers multiple benefits (coastal protection, fisheries and carbon sequestration) and relies on community involvement and enforcement. | High | Medium |
| | **Climate adaptive management** is a crucial approach for navigating the uncertainties of climate change and ensuring the effectiveness of adaptation and mitigation efforts over time. It is essential to cope with uncertainty, complexity and long-term planning. It promotes flexibility and learning and requires strong governance and data availability. | Medium | High |
| | **Ecosystem-based management** is a holistic approach that balances ecological health, human well-being and multiple ecosystem uses. It prioritizes maintaining ecosystem integrity while adapting management strategies based on new information. It provides a framework for integrating climate change considerations into all aspects of resource management. It also requires strong governance, scientific information and stakeholder engagement. | Medium | High |

Source: Adapted from IPCC AR6 WGII.

ARTICLE

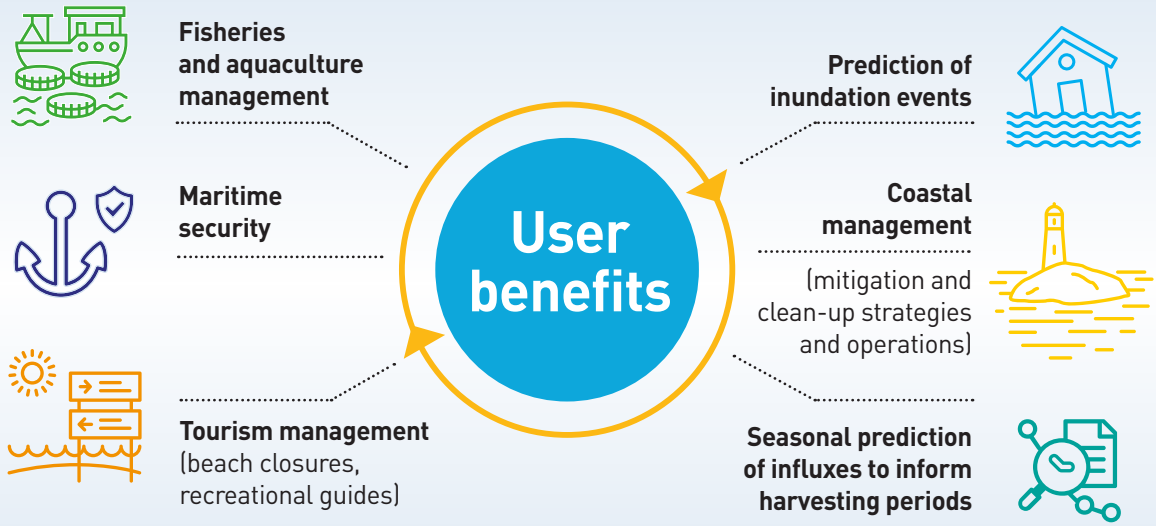
# EU4OceanObs cases for decision-makers and local authorities

*By Audrey Hasson (GEO Blue Planet/Mercator Ocean International)*

**EU4OceanObs is developing case studies on the Earth observation value chain on ocean and coastal-related themes. The EU4OceanObs case studies raise awareness of ocean challenges and highlight the societal benefits of the Earth observation value chain in creating solutions.**

The goal is to generate more interest in and uptake of marine data, increase the development of ocean and coastal observation-driven solutions and drive global commitment and funding to support ocean observations. The case studies showcase the importance of Earth observation in enhancing ocean knowledge and understanding towards sustainable development and protection of marine ecosystems and coastal communities.

The themes selected are aligned with the activities of GEO Blue Planet and the G7 Future of the Seas and Oceans Initiative. Existing use cases include Sargassum (a genus of large brown seaweeds), eutrophication, fisheries, Arctic Sea ice, marine litter, marine biodiversity and coastal resilience.




Source: https://www.eu4oceanobs.eu/use-cases

A20
Adaptation success
REFER TO PG. 76

## Indicators of effective adaptation

To track the effectiveness of coastal and ocean adaptation strategies in a NAP is crucial to use clear, measurable and context-specific indicators. These indicators help assess progress, guide decision-making and ensure accountability (see Table 10).

**Table 10. Examples of indicators of the effectiveness of adaptation and associated examples for a coastal and ocean setting**

| TYPE OF EFFECTIVENESS | INDICATORS | RECOMMENDATIONS | ACTIONS |
|---|---|---|---|
| **Reduce risk and vulnerability** | Biophysical and social vulnerability to potential climate hazards | Undertake coastal risk and vulnerability assessments at realistic intervals (five years) and adjust adaptation actions in NAP. | A 1 Risks |
| **Enhance social well-being** | Relationships, community building, collaboration, improved access to resources and information | Develop institutions for coastal and ocean governance and management and engage societal actors across levels of administration. This may be linked to ocean and coastal legislation and policy. | A 4 Leverage networks<br>A 5 Organize relationships<br>A 6 Stakeholder action |
| **Improve environment** | Ecosystem health, environmental quality, natural resources | Undertake state of the environment reports, stock assessments, etc. to evaluate the condition of ecosystems, their services and environmental conditions. | A 13 State of the environment, including social economy |
| **Increase economic resources** | Income levels, access to economic resources | Monitor the living standards of coastal communities, the state of local economic development and small to medium-sized enterprises in coastal and ocean sectors. | A 13 State of the environment, including social economy |
| **Strengthen institutions** | Institutional policies, governance structures and practices, partnerships, conflict resolution | Create a system of multi and polycentric coastal and ocean governance and management. Using existing coastal and ocean legislation and policy (ICZM and MSP laws, etc.) create nested and networked institutions that support adaptation. | A 4 Leverage networks<br>A 5 Organize relationships<br>A 6 Stakeholder action |
| **Enhance justice** | Coastal demographics, levels of income, education, health and livelihoods of marginalized communities and peoples | Create and negotiate the involvement of all important societal actors on the coast and oceans irrespective of the agency that they may have. Create opportunities for the involvement of important and relevant rather than "loud" and visible actors. | A 6 Stakeholder action |

# Implementation of adaptation measures for the Spanish Ports System

ARTICLE

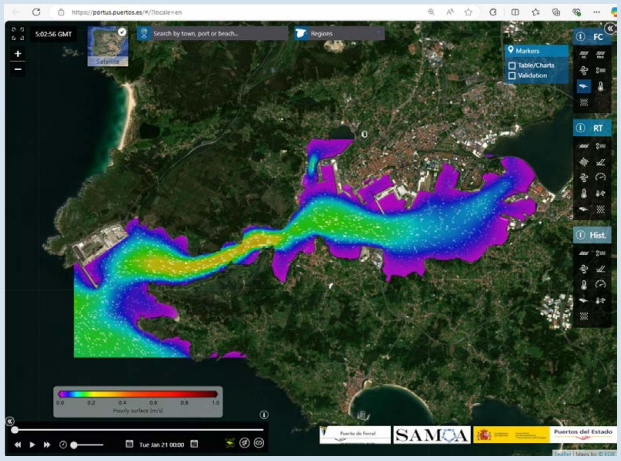
*By Begoña Pérez Gómez (Puertos)*

**Ports are particularly vulnerable to the risks and impacts of climate change, including sea level rise and extreme events such as storm surges and waves. These impacts can negatively affect national economies. To address this challenge and align with the objectives of the National Climate Change Adaptation Plan for the decade (2021–2030), the Spanish Ports System incorporated the implementation of adaptation measures in its strategic plan in October 2022**

The objective is to ensure the operability of physical elements and critical assets while anticipating and responding efficiently to potential downtime, disruption or operational delays.

The roadmap to achieving this strategic goal relies on the implementation of the largest operational oceanography system in the country. This system comprises more than 90 observation platforms, some with more than 30 years of data, providing real-time information and climatic information on essential ocean variables in the vicinity of the ports (sea level, waves, currents, sea surface temperature and salinity). Additionally, more than 100 operational numerical models have been developed and implemented in recent years (SAMOA project: Álvarez Fanjul *et al.*, 2018) and currently deliver forecasts for these variables at coastal and harbour scales.

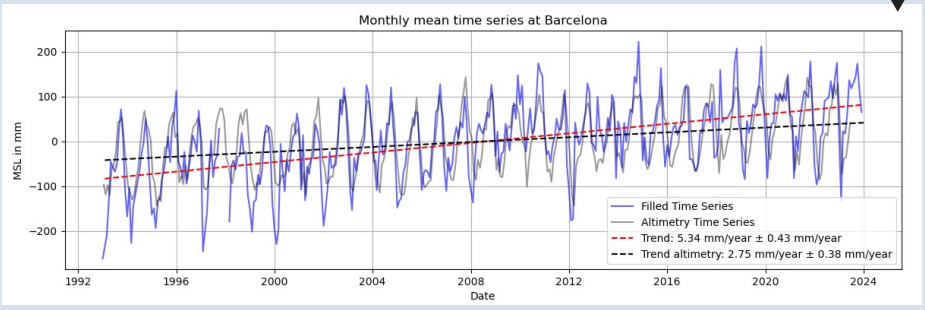
All these data are managed and integrated into various visualization tools by the state public agency, Ports of Spain, supporting decision-making and operations for most of the 46 general interest ports. The high resolution achieved by these models (50 m to 200 m) could form the basis for downscaling existing global and regional projections under different scenarios. This level of detail will enable climate risk assessments at the resolution required by port managers, allowing them to make timely decisions on climate change adaptation measures.




**Snapshot of surface currents forecast for the port of Ferrol in Spain on 21 January 2025**

Source: https://portus.puertos.es/#/?locale=en

**Barcelona tide gauge (radar sensor and GNSS antenna for vertical land movement) and a graph showing monthly means and trends from the tide gauge and the altimetry in the vicinity of Barcelona port**




Source: **Fanjul, E.A., Sotillo, M.G, Pérez Gómez, B., García-Valdecasas, J.M., Bernal, J.M., Pérez-Rubio, S., Lorente, P., Dapena, A., Marco, I., Luna, M.Y., *et al.* 2018**. Operational oceanography at the service of the ports. In: E. Chassignet, A. Pascual, J. Tintoré & J. Verron, eds. New frontiers in operational oceanography. https://doi.org/10.17125/gov2018.ch27

A19

## Nature-based solutions to support coastal and ocean adaptation

REFER TO PG. 66

NbS for the adaptation of ocean and coastal ecosystems are specifically designed to enhance coastal structures or leverage natural coastal habitats and features. They can deliver a variety of benefits to both communities and the environment and are seen as a robust, multifunctional, versatile and cost-effective solution to address contemporary socioenvironmental challenges (Table 11).

**Table 11. Examples of nature-based solutions**

| CATEGORY | DESCRIPTION | EXAMPLE |
|---|---|---|
| **Coastal protection** | Natural reduction of hydrodynamic forces to diminish risks to communities and infrastructure | Mangroves reduce wave energy; coral reefs dissipate wave energy and provide substantial protection against natural hazards; seagrass meadows facilitate sediment capture; salt marshes bind sediments and reduce wave action. Intact coastal ecosystems improve water quality by preventing salt water intrusion. |
| **Economic contributions** | Enhanced fisheries and tourism sectors supporting global economies | Fisheries' productivity linked to healthy seagrass meadows and tourism near coral reefs. |
| **Environmental beauty** | Improved visual and recreational value fostering cultural and ecosystem-based activities | The restoration of dunes and salt marshes can create attractive coastal areas and opportunities for eco-tourism. |
| **Green employment*** | Development of jobs within the Green Economy through restoration and sustainable management | Jobs in mangrove restoration projects; sustainable fisheries and eco-tourism initiatives. |
| **Ecological resilience** | Strengthened ecosystem stability against environmental disturbances and perturbations | Preservation of salt marshes to buffer storm impacts; oyster reefs improve water quality through filtration and provide attachment points for colonizing species; coral reefs support habitats for marine life and bolster biodiversity; mangroves serve as nursery habitats and contribute to climate regulation. |

*A Green Economy is defined as low-carbon, resource-efficient and socially inclusive. In a Green Economy growth in employment and income is driven by public and private investment in these economic activities, infrastructure and assets that allow reduced carbon emissions and pollution, enhanced energy and resource efficiency and prevention of the loss of biodiversity and ecosystem services.

Source: https://www.unep.org/regions/asia-and-pacific/regional-initiatives/supporting-resource-efficiency/green-economy

A9

## UN4NAPs

REFER TO PG. 65

UN4NAPs is a United Nations-wide rapid technical backstopping initiative for NAPs.

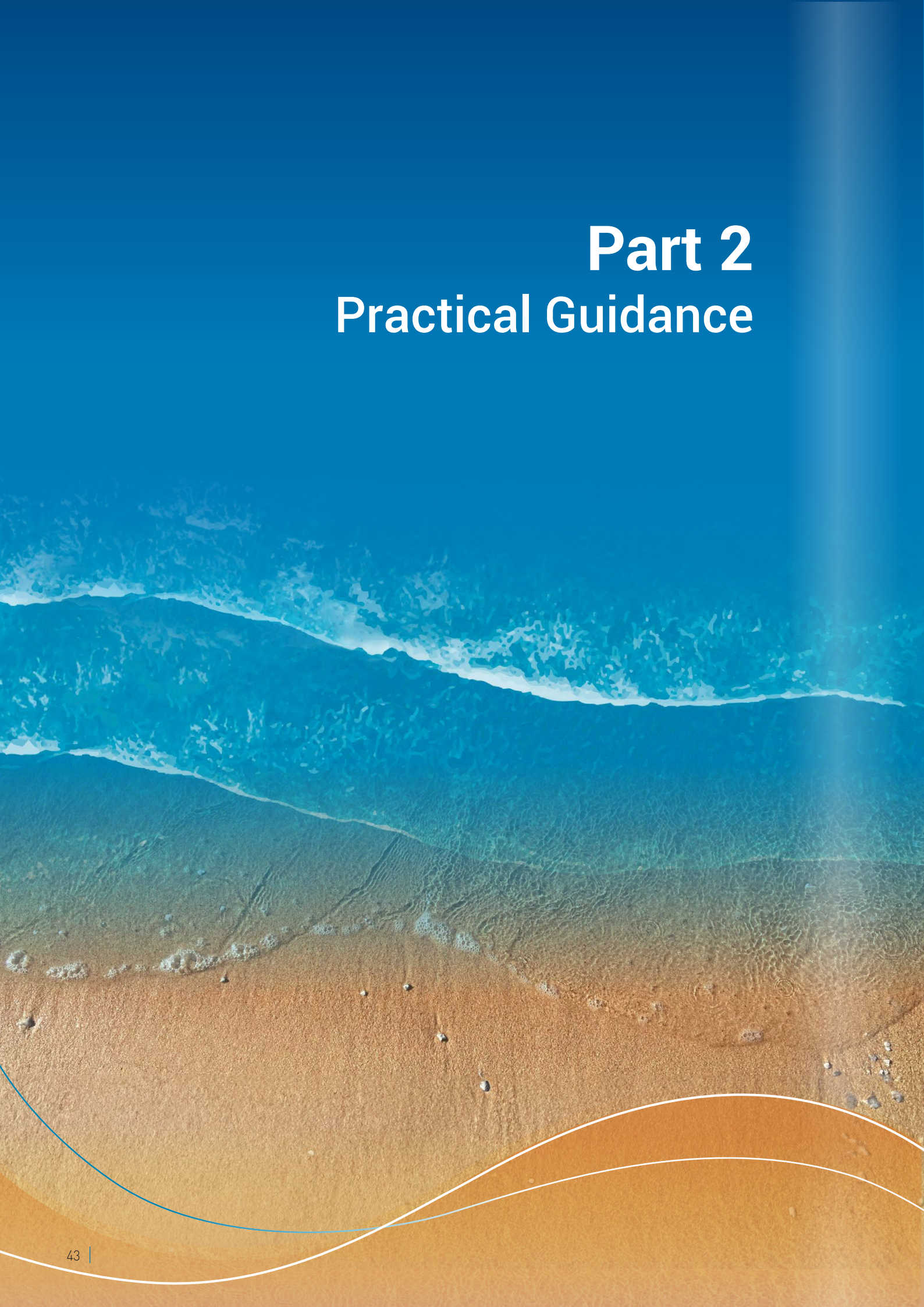
When requests are received for technical assistance, the UNFCCC secretariat immediately communicates with relevant partners from a roster of more than 50 United Nations and intergovernmental organizations for a prompt response.

The categories of technical assistance that can be catalysed between specific agencies and countries are:

- Direct technical queries that can be answered by relevant agencies via email;
- Delivery of specific data/knowledge products (such as datasets, analytical tools, guidance material);
- Longer-term technical capacity development and engagement with the requesting country; and
- Review of draft NAPs on request by a country.

Planting mangroves along the shoreline, restoring natural habitats.
© AdobeStock

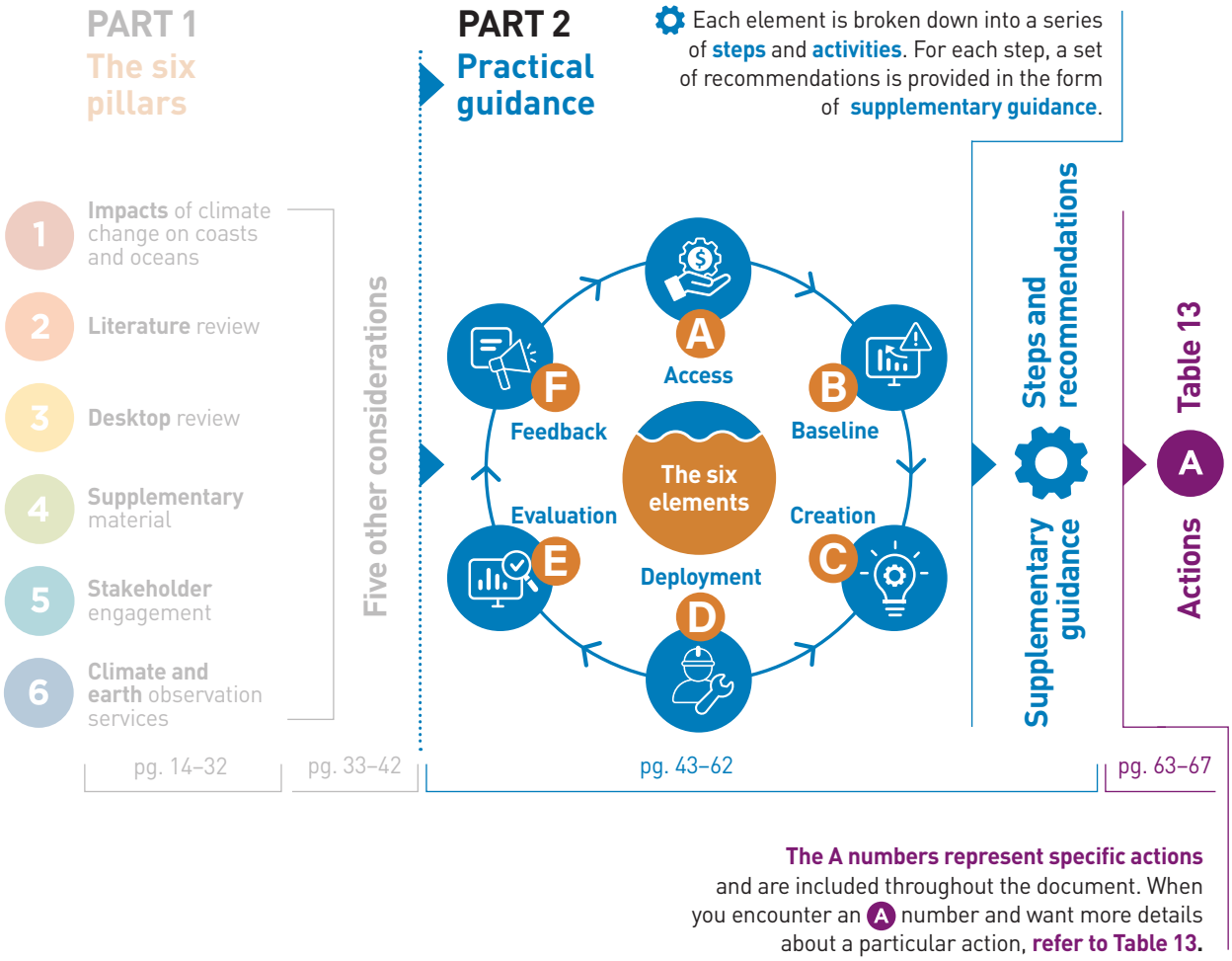
# Part 2
## Practical Guidance



**The guidance presented in Table 12 will assist LDCs to improve or initiate the inclusion of coastal and ocean adaptation requirements in the NAP development process.**

Guidance is provided as a series of six elements, each broken down into simple steps and activities, along with helpful recommendations for implementation. The guidance links back to and is supported by the pillars and five other considerations presented in Part 1.

**Figure 3. How to use the tables in Part 2**




## Guidance to improve or initiate the inclusion of coastal and ocean adaptation requirements in the National Adaptation Plan development process

The six elements and steps of the NAP Technical Guidance are reframed for coastal and ocean adaptation. Not all steps and activities from the Technical Guidance are relevant and some are omitted or rephrased. The six elements and steps to strengthen the inclusion of coasts and oceans in the NAPs are shown in the tables on the following pages.

ELEMENT A

# A Access

## Maintaining the National Adaptation Plan process by accessing funding, data and capacity-sharing

| STEPS | ACTIVITIES FOR COASTAL AND OCEAN ADAPTATION | SUPPLEMENTARY GUIDANCE | ACTIONS |
|---|---|---|---|
| **ACCESS FUNDING to support the process of formulating and implementing of specific coastal and ocean-specific, capacity-sharing and related enabling activities.** | • Access funding from the national fiscus through ministerial or departmental budgets.<br>• Access funding from external (development or bilateral agreements) and other sources (local and private) for NAP implementation.<br>• Consolidate adaptation funding for ocean and coastal areas via national funding for mechanisms to establish MSP and ICZM.<br>• Continue to build capacity for coastal and ocean adaptation based on identified priority needs.<br>• Create and strengthen the participation of societal stakeholders in coastal and ocean management, adaptation and governance. | **Financial resource mobilization:**<br>• Assess the financial resources required for coastal and ocean adaptation and explore opportunities for mobilizing domestic and international funding.<br>**Resource mobilization and international cooperation (global and regional scales):**<br>• Seek international climate finance for coastal and ocean adaptation projects.<br>• Promote cross-border cooperation on shared marine ecosystems.<br>• Explore innovative financing solutions for NbS and climate smart Blue Economy initiatives.<br>**Resource mobilization for capacity-building for key stakeholders:**<br>• Develop a targeted capacity-sharing plan for coastal and ocean adaptation focusing on key stakeholder groups (e.g., government officials, local communities and the private sector).<br>• Design and implement training programmes to build the capacity of key societal actors in coastal and ocean adaptation.<br>**Leveraging local resources and coordination:**<br>• Coastal communities are also invested in terms of their well-being and are often willing to contribute resources for the common good. Financial resources remain a key barrier to the implementation of adaptation, but coordination, division of labour and the identification of roles and responsibilities can temporarily and partially alleviate the need for substantial external financing.<br>**Explore and leverage private funding mechanisms**<br>• To secure financial resources from private entities to support and advance sustainable initiatives within the Blue Economy. (e.g., sustainable aquaculture, renewable ocean energy, eco-tourism, marine biotechnology, sustainable shipping and port development, coastal protection and restoration companies) through partnerships, impact investments, corporate social responsibility initiatives and public-private partnerships. | A 2 Obtain expert assistance<br>A 4 Leverage networks<br>A 5 Organize relationships<br>A 6 Stakeholder action<br>A 11 Capacity assessment<br>A 12 Policy decision<br>A 17 NAP and adaptation funding |

| STEPS | ACTIVITIES FOR COASTAL AND OCEAN ADAPTATION | SUPPLEMENTARY GUIDANCE | ACTIONS |
|---|---|---|---|
| **LAY THE GROUNDWORK for implementation and resource mobilization for addressing coastal and ocean climate change.** | • Support functions of designated national authorities responsible for coastal and ocean management and development to process adaptation projects.<br>• Incentivize development of innovative financing solutions, possibly through allocating resources as part of planning and implementing the Blue Economy.<br>• Integrate adaptation in coastal and ocean planning processes, e.g., MSP, MPAs and ICZM.<br>• Create enabling environment for the private sector to participate in the implementation of coastal and ocean adaptation via Blue Economy planning, or similar. | **National policy and strategic framework (national scale):**<br>• Countries make decisions on the fundamental economic, ecological and social importance of coasts and oceans. These decisions consider the many sectors directly and indirectly dependent on coasts and oceans.<br>• In many instances this is understood as the Blue Economy. All countries with coastlines have economic activities dependent on the coasts and oceans, and a formal Blue Economy strategy might exist.<br>• Enhance or create a vision for coasts and oceans in NAPs, or as a stand-alone sectoral NAP. Draw on existing coastal or ocean governance policies.<br>• Incorporate ecosystem service values into national accounting.<br>• Consider the specific vulnerability of SIDS, if applicable.<br>**Integrating into governance:**<br>• The capacity of the NAP development team must be considered, as well as the capacity (human, financial resources, etc.) to implement coastal adaptation options.<br>• An important part of NAP development and the implementation of coastal and ocean adaptation at a national level is to use and improve existing governance mechanisms (e.g., ICZM, MSP and MPAs).<br>• In most countries the mechanism for the management of set-back lines, coastal development regulations, estuaries, coasts and shorelines can be an effective tool for implementing adaptation options.<br>• Such mechanisms can be effective once the adaptation options are selected and agreed but require policy support and practical implementation.<br>• It may also be necessary to strengthen existing policy and draft new policy and legislation to support and implement adaptation options. The development of realistic timelines for implementation, coupled with M&E of implementation and the success of adaptation are critical parts of the NAP process.<br>• Coastal and ocean adaptation action requires people, organizations, coordination and planning. Available capacity (human and financial resources) will determine how roles and responsibilities in adaptation planning and implementation will be allocated or decided. | A 4 Leverage networks<br>A 5 Organize relationships<br>A 6 Stakeholder action<br>A 7 Legal and policy advice<br>A 12 Policy decision<br>A 18 Cross-sectoral adaptation |

A

ELEMENT

| STEPS | ACTIVITIES FOR COASTAL AND OCEAN ADAPTATION | SUPPLEMENTARY GUIDANCE | ACTIONS |
|---|---|---|---|
| **BUILD OR UPDATE A DATA AND KNOWLEDGE BASE for coastal and ocean adaptation needs and actions** | • Develop data policies and data-sharing protocols between ministries and different stakeholders in the coastal and ocean domain.<br>• Conduct stocktaking, mapping and synthesis of available information relevant to coastal and ocean adaptation.<br>• Assemble relevant goals and plans for development of the coastal and ocean domain (e.g., Blue Economy, MSP) for the country from relevant ministries and other relevant stakeholders.<br>• Assemble relevant data, models, tools and knowledge systems for the coastal and ocean domain. | **Knowledge sharing and awareness raising:**<br>• Promote knowledge sharing and exchange of best practices on coastal and ocean adaptation through regional workshops, training programmes and online platforms.<br>• Establish a mechanism for delivering technical assistance and support to local communities and small businesses in implementing adaptation measures.<br>• Strengthen the integration of climate change considerations into coastal and marine education curricula at all levels.<br>**Identifying and accessing data and information:**<br>• Identify and establish relationships with national and regional organizations that provide or facilitate access to climate data and Earth observations. This may include meteorological services, United Nations agencies, universities, non-governmental organizations (NGOs) and the private sector.<br>• Establish access to information about coastal and ocean climate hazards, risk and vulnerability. FAIR information is fundamentally important to prioritize adaptation action.<br>• An important consideration is to identify and establish access to appropriate climate change data and information, climate services and Earth observation products and services. This may include data and information from various sources, including academia, research institutions, government agencies, the private sector and civil society.<br>• Also identify national or regional climate service providers that can provide support with bespoke scientific information services.<br>**Ensuring data quality and management:**<br>• Establish a data management protocol for accessible, reliable and long-term preservation of coastal and ocean climate data, including quality control and metadata standards.<br>**Broadening the scope of the stocktake:**<br>• Stocktake and validate local and traditional knowledge on coastal and ocean climate change.<br>• Map coastal and ocean adaptation initiatives (objectives, areas, activities and funding).<br>**Identifying knowledge gaps:**<br>• Identify key knowledge gaps about climate impacts on coastal and ocean species, habitats and services.<br>**Contextualizing the stocktake:**<br>• Recognize the climate hazards threatening the Blue Economy and the risk and vulnerability that must be considered in adaptation planning.<br>• National or subnational "state of the coastal and ocean environment" assessment provides critical baseline information to establish adaptation goals and track progress. | A 2 Obtain expert assistance<br>A 3 Data and information<br>A 4 Leverage networks<br>A 7 Legal and policy advice<br>A 8 Information infrastructure<br>A 11 Capacity assessment<br>A 12 Policy decision<br>A 18 Cross-sectoral adaptation<br>A 19 Nature-based solutions (NbS)<br>A 22 Earth observation<br>A 23 Climate services |

| STEPS | ACTIVITIES FOR COASTAL AND OCEAN ADAPTATION | SUPPLEMENTARY GUIDANCE | ACTIONS |
|---|---|---|---|
| **STRENGTHEN INSTITUTIONAL ARRANGEMENTS AND REGULATORY FRAMEWORKS affecting coastal and ocean adaptation across scales and levels of administration and sectors.** | • Create or update formal mandates and legislation for coastal and ocean adaptation as appropriate.<br>• Strengthen coordination mechanisms between ministries, national departments and various levels of administration from national to local.<br>• Strengthen the coordination mechanism for coastal and ocean adaptation at the regional and international scales, also for scientific support. | **Institutional arrangements and coordination (national and subnational scales):**<br>• Designate or create institutions and organizations to take responsibility for coastal and ocean adaptation.<br>• Ensure inclusion of actors across Blue Economy sectors.<br>• Coastal and ocean adaptation planning and implementation teams should develop an understanding of the "organizational universe" within the country, answering questions like: "Who are the key actors across the levels of administration?" and "who are the key societal actors that must be consulted?"<br>• Adaptation actions that are distributed across scales and different levels of administration will take responsibility for different actions. At the local level, civil society, NGOs and the private sector will all need to act. Identifying the key coastal and ocean sectors (public and private) that must adapt to climate change is essential.<br>**Community and equity considerations (local scale):**<br>• Prioritize coastal resource contributions to poverty reduction and food security.<br>• Integrate traditional knowledge into adaptation planning, engaging local communities.<br>• Address gender inequalities in coastal resource access and control.<br>**Addressing capacity gaps:**<br>• In many instances, especially in LDCs, there remains a dearth of capacity to undertake adaptation to climate change. All possible avenues to supplement and enhance capacity should be considered, including using special channels like UN4NAPS, supplementary material and capacity development programmes, etc.<br>• Provide training and technical assistance to local communities and small businesses on implementing adaptation measures.<br>• Promote the integration of climate change adaptation into higher education and vocational training programmes.<br>**Strengthening government capacity for climate finance:**<br>• Strengthen the capacity of national and subnational governments to access and manage climate finance for adaptation. | A 4 Leverage networks<br>A 5 Organize relationships<br>A 6 Stakeholder action<br>A 7 Legal and policy advice<br>A 11 Capacity assessment<br>A 12 Policy decision<br>A 18 Cross-sectoral adaptation |

Brazil
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ELEMENT B

# B Baseline

## Assessment and pre-planning

| STEPS | ACTIVITIES FOR COASTAL AND OCEAN ADAPTATION | SUPPLEMENTARY GUIDANCE | ACTIONS |
|---|---|---|---|
| **DEVELOP PLAUSIBLE CLIMATE CHANGE and socio-economic scenarios for the medium and long-term** | • Develop a plausible scenario for future coastal and ocean climate, guided by the global temperature goal of 1.5°C<br>• Develop corresponding socio-economic scenarios for the medium- and long-term.<br>• Assemble relevant projections such as for economic growth, social development, population of coastal areas and ocean activities. | **Principles for effective implementation:**<br>• The implementation of coastal and ocean adaptation is a long-term process that must start immediately, even with limited or no resources and capacity. The focus must be on adaptation actions that are readily implementable at low cost, have a quick and positive impact and support the development of a sustainable Blue Economy and enhance the well-being of coastal communities.<br>• Prioritize adaptation actions that are scalable and may be replicated across different coastal contexts and ecosystems. | A 1 Risks<br>A 2 Obtain expert assistance<br>A 3 Data and information<br>A 8 Information infrastructure<br>A 9 UN4NAPS<br>A 10 Technical and scientific diplomacy<br>A 13 State of the environment (coast), including social economy<br>A 22 Earth observation<br>A 23 Climate services |
| **CONDUCT ASSESSMENTS of climate hazard and exposure, vulnerability and risk for coastal areas and ocean activities** | • Apply the framing of coastal and ocean vulnerability and risk based on the IPCC AR6 to define the assessment approach (cf. Building Block 1, Table 1).<br>• Understand and estimate risk and vulnerability using applicable assessment methodologies, models and tools for the coastal and ocean domain. Consider the GGA thematic targets nested within the coastal and ocean domain.<br>• Use a multistakeholder process to identify key risks and vulnerabilities to be addressed.<br>• Produce (and co-produce with different societal actors) outputs such as coastal and ocean risk indices to meet the needs of different stakeholders, including the private sector (Coastal Vulnerability Assessments, etc.). | **Vulnerability assessment and monitoring:**<br>• Establish systems to monitor and assess the vulnerability of coastal communities, their diverse livelihoods and ecosystems to climate change, while also enhancing their resilience.<br>• Develop and apply climate risk assessment tools to evaluate the potential impacts of climate change on coastal and ocean development projects.<br>• Regularly update vulnerability assessments to account for new climate change projections and emerging risks.<br>**Blue Economy and climate change:**<br>• Assess the vulnerability of key Blue Economy sectors (e.g., fisheries, tourism and aquaculture) to climate change impacts.<br>• Identify opportunities for diversifying and strengthening the resilience of Blue Economy livelihoods to climate change. | A 1 Risks<br>A 2 Obtain expert assistance<br>A 3 Data and information<br>A 6 Stakeholder action<br>A 8 Information infrastructure<br>A 9 UN4NAPS<br>A 13 State of the environment (coast), including social economy<br>A 18 Cross-sectoral adaptation<br>A 22 Earth observation<br>A 23 Climate services |

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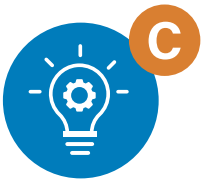
ELEMENT C



# C Creation

## Plan development

| STEPS | ACTIVITIES FOR COASTAL AND OCEAN ADAPTATION | SUPPLEMENTARY GUIDANCE | ACTIONS |
|---|---|---|---|
| **UNDERSTAND THE VISION for coastal and ocean management and the major thrusts of that aspirational vision (Blue Economy, biodiversity targets, MSP, ICM, sustainability of coastal communities)** | • Consider the aspirational future for the coast and ocean domain based on existing mechanisms such as ICZM, MSP and MPAs, also national development plans and strategies to define boundaries for coastal and ocean adaptation.<br>• Articulate how climate change will impact the aspirational state (e.g., delivery of benefits from the Blue Economy) in the context of climate change scenarios to inform framing of adaptation.<br>• Prioritize the resilience and well-being of sustainable coastal communities by ensuring adaptation activities directly support their long-term viability, livelihoods and cultural heritage in the face of changing coastal and ocean conditions. | **Integrating development and adaptation:**<br>• Compile, integrate and, where possible, align the various development goals of existing coastal and ocean governance mechanisms and institutions, e.g., ICZM, MSP and MPAs.<br>• Understand the relationship, overlap and conflicts between existing policies and institutions and set in motion processes for alignment. Such processes should consider the urgency of the changing climate and its impact on the social–ecological system.<br>• Develop criteria for climate-proofing investments in coastal and ocean infrastructure, ensuring resilience to sea level rise, extreme weather events and other climate change impacts.<br>• Prioritize adaptation measures that generate co-benefits for both development and environmental sustainability and coastal communities' well-being (e.g., mangrove restoration for coastal protection and carbon sequestration).<br>• Ensure consistency between NAPs and sectoral development plans for coastal and ocean areas. | A 5 Organize relationships<br>A 6 Stakeholder action<br>A 7 Legal and policy advice<br>A 10 Technical and scientific diplomacy<br>A 12 Policy decision<br>A 18 Cross-sectoral adaptation<br>A 22 Earth observation<br>A 23 Climate services |
| **FRAME coastal and ocean adaptation at the national level** | • Define new or existing institutional and governance arrangements for coastal and ocean adaptation.<br>• (Re)define the vision, goals and objectives of coastal and ocean management and adaptation in the context of national development.<br>• Define criteria for choice of systems to focus on and for ranking coastal and ocean adaptation options. | **National policy and strategic framework (national scale):**<br>• Countries make decisions on the fundamental economic, ecological and social importance of coasts and oceans. These decisions consider the many sectors directly and indirectly dependent on coasts and oceans and integrate the promotion and support of sustainable livelihoods within coastal and ocean adaptation strategies.<br>• In many instances this is understood as the Blue Economy. All countries with coastlines have economic activities dependent on the coasts and oceans and a formal Blue Economy strategy might exist.<br>• Enhance or create a vision for coasts and oceans in NAPs, or as a stand-alone sectoral NAP. Draw on existing coastal or ocean governance policies.<br>• Incorporate ecosystem services values into national accounting.<br>• Consider the specific vulnerability of SIDS, if applicable. | A 1 Risks<br>A 2 Obtain expert assistance<br>A 3 Data and information<br>A 8 Information infrastructure<br>A 12 Policy decision<br>A 18 Cross-sectoral adaptation<br>A 20 Adaptation success<br>A 21 Adaptation options<br>A 22 Earth observation<br>A 23 Climate services |

C

ELEMENT

| STEPS | ACTIVITIES FOR COASTAL AND OCEAN ADAPTATION | SUPPLEMENTARY GUIDANCE | ACTIONS |
|---|---|---|---|
| **SYNTHESIZE BEST AVAILABLE INFORMATION on climate hazard and exposure, vulnerability and risk from relevant assessments** | • Apply the framing of coastal and ocean vulnerability and risk based on the IPCC AR6 to define the approach for synthesizing assessment results.<br>• Synthesize risks and vulnerability for the coastal and ocean domain based on best available science.<br>• Use a multistakeholder process to identify key coastal and ocean risks and vulnerabilities to be addressed. | **Understanding climate change impacts and vulnerabilities:**<br>• Understand the likely future climate and how that may affect coasts and oceans, Blue Economy sectors, coastal cities and communities.<br>• Key actors in government, NGOs, the private sector and communities must work together to explore and produce a comprehensive and agreed understanding of vulnerability to climate change impacts on the coast and ocean.<br>• Develop an agreed method and criteria to list and rank coastal and ocean vulnerabilities to the impacts of climate change.<br>**Identifying and prioritizing adaptation options:**<br>• Identify potential adaptation actions and timing by sectors, cities, communities, etc.<br>• Consider both structural and non-structural adaptation options, including ecosystem-based approaches.<br>**Ensuring inclusive and equitable adaptation:**<br>• Use participatory approaches to assess vulnerabilities and identify adaptation options, ensuring the inclusion of local knowledge and community perspectives.<br>• Prioritize adaptation options that address the needs of the most vulnerable populations and promote social equity.<br>**Seeking external support:**<br>• Developing and implementing adaptation actions can be supported by processes outside of the country, especially at regional level and may include developing relationships with regional organizations related to providing data and information, guidance, advice and technical support.<br>• Support may be provided by regional meteorological services, United Nations agencies, conventions, etc.<br>**Collaboration and information sharing:**<br>• Participate in regional forums and initiatives on climate change adaptation and coastal management.<br>• Share information and best practices on coastal and ocean adaptation with other countries in the region.<br>**Alignment with regional and international frameworks**<br>• Align NAPs with relevant regional and international frameworks and agreements. | A 1 Risks<br>A 2 Obtain expert assistance<br>A 3 Data and information<br>A 4 Leverage networks<br>A 6 Stakeholder action<br>A 8 Information infrastructure<br>A 9 UN4NAPS<br>A 18 Cross-sectoral adaptation<br>A 19 Nature-based solutions (NbS)<br>A 20 Adaptation success<br>A 21 Adaptation options<br>A 22 Earth observation<br>A 23 Climate services |

| STEPS | ACTIVITIES FOR COASTAL AND OCEAN ADAPTATION | SUPPLEMENTARY GUIDANCE | ACTIONS |
|---|---|---|---|
| **IDENTIFY OPTIONS to address key coastal and ocean climate risks and vulnerabilities and build resilience** | • Propose coastal and ocean adaptation, risk management and resilience-building options to address the key risks and vulnerabilities, considering guiding principles related to gender responsiveness, IPs and local community issues, youth, etc.<br>• Appraise and rank the response options into priority adaptation solutions and actions. Consider the GGA thematic targets within the context of the coastal and ocean domain. | **Assessing and evaluating adaptation actions:**<br>• Consider the requirements, costs and potential benefits of priority coastal and ocean adaptation actions.<br>• Conduct a comprehensive cost–benefit analysis of different adaptation options, considering both economic and non-economic values.<br>• Assess the potential social and environmental impacts of adaptation measures, ensuring that they do not exacerbate existing inequalities or harm ecosystems. | A 6 Stakeholder action<br>A 7 Legal and policy advice<br>A 8 Information infrastructure<br>A 18 Cross-sectoral adaptation<br>A 19 Nature-based solutions (NbS)<br>A 20 Adaptation success<br>A 21 Adaptation options<br>A 22 Earth observation<br>A 23 Climate services |
| **ESTIMATE COSTS for coast and ocean implementation** | • Estimate costs of implementing the priority adaptation solutions and actions. | • Estimate and allocate costs for coastal and ocean adaptation either as standalone budget items across multiple levels and funding sources, or embedded as part of budgets for existing management and governance mechanisms such as MSP, ICZM etc. | A 7 Legal and policy advice<br>A 17 NAP and adaptation funding<br>A 18 Cross-sectoral adaptation |
| **COMPILE THE COASTAL AND OCEAN ADAPTATION OPTIONS and embed in NAP or develop a standalone coastal and ocean NAP** | • Define an implementation strategy that assigns coastal and ocean adaptation actions to appropriate levels of national to local administration and other stakeholders.<br>• Consider transboundary and multi-country, regional approaches to the implementation of actions and projects.<br>• Compile a draft NAP and include priorities from sectoral, subnational or local plans prepared in parallel for stakeholder endorsement and validation.<br>• Integrate the NAP priorities into sectoral, subnational plans and local plans as necessary.<br>• Submit the nationally endorsed NAP to the UNFCCC | **Developing and implementing adaptation programmes:**<br>• Develop an agreed suite of adaptation across sectors, scales and communities.<br>• Develop a programme for supporting funding and monitoring adaptation options. Prioritize low-cost, high-impact adaptation options with multiple co-benefits to sectors or communities.<br>**Utilizing resources and considering NbS:**<br>• Consider the information and supplementary guidance relevant to coasts and oceans provided by the UNFCCC.<br>• Consider the use of NbS as part of the suite of adaptation actions.<br>**Engaging stakeholders:**<br>• Engage stakeholders in the review and appraisal process, ensuring that their perspectives and concerns are considered. | A 6 Stakeholder action<br>A 12 Policy decision<br>A 16 Plan and track NAP process<br>A 18 Cross-sectoral adaptation<br>A 19 Nature-based solutions (NbS)<br>A 20 Adaptation success<br>A 21 Adaptation options |

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ELEMENT D

# D Deployment

## Implementation and financing strategy and resource mobilization

| STEPS | ACTIVITIES FOR COASTAL AND OCEAN ADAPTATION | SUPPLEMENTARY GUIDANCE | ACTIONS |
|---|---|---|---|
| **DEVELOP A RESOURCE MOBILIZATION STRATEGY for coastal and ocean adaptation at different levels of administration and with various societal stakeholders** | • Map coastal and ocean adaptation priority actions into project ideas and programmes.<br>• Integrate coastal and ocean adaptation priority projects into existing ministerial, departmental strategies and link to budget cycle.<br>• Develop a programme for implementing the coastal and ocean adaptation actions that is aligned with NAP and other management and governance mechanisms such as ICZM and MSP.<br>• Target a variety of funding and financing windows for the projects or combinations of windows in blended financing.<br>• Follow the relevant project or funding cycles to prepare funding requests (in the form of project proposals or other formats as applicable). | **Prioritizing adaptation in the Blue Economy and local development:**<br>• Adaptation in key economic sectors of the Blue Economy must be prioritized. This requires countries to understand the relevance of the Blue Economy and its contribution to national accounts, currently and in future.<br>• Climate adaptation must also consider the social, political and economic importance of coasts and oceans for local economic development of coastal communities.<br>**Integrating adaptation into policy and planning instruments:**<br>• Enhance existing coastal and ocean policy instruments, (e.g., ICZM, MSP, MPAs) and include targets for adaptation.<br>• Include coastal and ocean adaptation in development planning at national and subnational level.<br>**Stakeholder engagement and collaboration:**<br>• Planned adaptation requires people, organizations, networks, government and the private sector to work together to reduce the impact of climate change and adapt to it.<br>• Across sectors and levels of administration, coastal adaptation planning requires the same commitment to stakeholder engagement that is prescribed for ICZM, MSP and MPAs.<br>• Clearly identifying societal and government stakeholders in a transparent and engaging manner is key to the common effort needed to effect change and implement actions.<br>• Local, national and regional networks that have or support similar adaptation goals are all part of a distributed network of stakeholders needed to adapt to global climate change.<br>**Strategic decision-making and private sector involvement:**<br>• Develop a clear and transparent process for prioritizing adaptation investments, based on criteria such as vulnerability reduction, cost-effectiveness and contribution to sustainable development.<br>• Engage the private sector in identifying and implementing innovative adaptation solutions for the Blue Economy. | A 2 Obtain expert assistance<br>A 4 Leverage networks<br>A 5 Organize relationships<br>A 6 Stakeholder action<br>A 7 Legal and policy advice<br>A 12 Policy decision<br>A 16 Plan and track NAP process<br>A 18 Cross-sectoral adaptation<br>A 19 Nature-based solutions (NbS) |

| STEPS | ACTIVITIES FOR COASTAL AND OCEAN ADAPTATION | SUPPLEMENTARY GUIDANCE | ACTIONS |
|---|---|---|---|
| *Continued...*<br>**DEVELOP A RESOURCE MOBILIZATION STRATEGY**<br>**for coastal and ocean adaptation at different levels of administration and with various societal stakeholders** | | **Leveraging existing knowledge:**<br>• There are known adaptation options for coastal and ocean areas which should be considered (e.g., IPCC reports).<br>**Mobilizing financial resources for adaptation:**<br>• The mobilization of financial resources and direct investment in adaptation requires effort across scales and levels of administration.<br>• Promote the use of innovative financing mechanisms such as green bonds and insurance schemes to support adaptation investments.<br>**Integrating adaptation into Blue Economy sectors:**<br>• National planning of the Blue Economy must also include adaptation planning for individual priority sectors, e.g., fisheries and tourism.<br>• Large economic sectors (in the Blue Economy) have an incentive to invest in their own best interest but can also cross-subsidize at smaller scales where there are dependencies on labour pools, skills and expertise and geography.<br>• Integrate climate change adaptation into sector-specific policies and programmes for the Blue Economy (e.g., fisheries management plans and tourism development strategies). | |
| **IMPLEMENT AND EXECUTE**<br>**adaptation and risk management and resilience solutions** | • Manage implementation of coastal and ocean adaptation projects and execute adaptation solutions.<br>• Develop and apply systematic observation and monitoring of coastal and ocean systems under adaptation intervention to identify triggers or nodes for changes in adaptation pathways. | **Implementation:**<br>• Develop clear timelines for adaptation actions across multiple sectors and levels from national to local.<br>• Establish institutional mechanisms for coordinating and overseeing the integration of climate change adaptation into coastal and ocean planning.<br>• Develop indicators and targets for monitoring progress on integrating adaptation into development planning.<br>• Provide incentives for local governments and communities to implement climate change adaptation measures in coastal areas.<br>**Monitoring progress:**<br>• Establish clear targets and indicators for monitoring the progress of the implementation of the adaptation strategy. | A 4 Leverage networks<br>A 6 Stakeholder action<br>A 14 Monitoring and evaluation<br>A 16 Plan and track NAP process<br>A 18 Cross-sectoral adaptation<br>A 19 Nature-based solutions (NbS)<br>A 20 Adaptation success<br>A 22 Earth observation<br>A 23 Climate services |

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ELEMENT E

# E Evaluation

## Monitoring, evaluation and learning

| STEPS | ACTIVITIES FOR COASTAL AND OCEAN ADAPTATION | SUPPLEMENTARY GUIDANCE | ACTIONS |
|---|---|---|---|
| **SYSTEMATIC DATA COLLECTION to inform coastal and ocean adaptation and monitoring including progress** | • Develop or apply monitoring & evaluation (M&E) systems to track progress, effectiveness and gaps in coastal and ocean adaptation.<br>• Apply protocols for data collection for monitoring key coastal and ocean variables, guided by metrics and indicators, as appropriate.<br>• Monitor and document coastal and ocean climatic events to improve understanding of impacts, vulnerabilities and risks to inform further adaptation responses. | **Assessing the state of the environment:**<br>• Good practice would be to establish the state of the coastal and ocean environment at regular intervals. This benefits ICZM and adaptation success.<br>• Overall, the state of the environment is an important indicator of the need for adaptation, e.g., mangrove coverage and decline and community vulnerability to wave inundation.<br>**Earth observation:**<br>• Earth observation can also support monitoring of adaptation success.<br>**Monitoring adaptation progress and financial resources:**<br>• Establish a baseline of key indicators related to coastal and ocean health, climate vulnerability and adaptation progress.<br>• Develop a system for tracking the financial resources allocated to coastal and ocean adaptation and their effectiveness in achieving the desired outcomes.<br>**Community engagement in monitoring:**<br>• Engage local communities in monitoring and reporting on adaptation progress, utilizing citizen science initiatives where appropriate.<br>**Measuring success:**<br>• The improvement in the state of the environment can be a powerful indicator of adaptation success.<br>• Coastal and ocean adaptation success or failure is a prompt for re-evaluation and updating adaptation actions.<br>**Alignment with policy cycles:**<br>• Coastal and ocean adaptation actions should be aligned with the policy implementation cycle of other mechanisms such as ICZM, MSP and MPAs.<br>**Adaptive planning:**<br>• Ensure that adaptation plans are updated regularly to reflect new climate change projections, emerging risks and lessons learned from implementation.<br>• Integrate the findings of vulnerability assessments and adaptation effectiveness evaluations into updated adaptation plans.<br>**Integration with broader development priorities:**<br>• Align adaptation plans with national development priorities and sectoral strategies. | A 3 Data and information<br>A 4 Leverage networks<br>A 5 Organize relationships<br>A 6 Stakeholder action<br>A 8 Information infrastructure<br>A 11 Capacity assessment<br>A 12 Policy decision<br>A 13 State of the environment (coast), including social economy<br>A 14 Monitoring and evaluation<br>A 16 Plan and track NAP processng and evaluation<br>A 20 Adaptation success<br>A 22 Earth observation |

| STEPS | ACTIVITIES FOR COASTAL AND OCEAN ADAPTATION | SUPPLEMENTARY GUIDANCE | ACTIONS |
|---|---|---|---|
| **PERIODIC EVALUATION AND LEARNING** | • Assess limits to multi-scale adaptation and identify opportunities for transformation of coastal and oceans communities, systems (Blue Economy, etc.).<br>• Periodically assess and evaluate progress and effectiveness (and other parameters) based on data from the regular monitoring, including through independent assessments).<br>• Capture lessons learned in addressing coastal and ocean adaptation to inform subsequent actions.<br>• Assess effectiveness of coastal and ocean adaptation and whether maladaptation is taking place. | **Iterative improvement through review and evaluation:**<br>• An evaluation of the implementation of coastal and ocean adaptation is important to progressively improve the outcome of actions.<br>• The inclusion of a review as part of the implementation cycle means that each iteration improves the process, actions and outcomes.<br>**Establishing timelines and reporting successes:**<br>• Firm but realistic timelines and reporting of successes are essential to long-term adaptation outcomes.<br>**Participatory reviews and effectiveness assessment:**<br>• Conduct regular reviews of adaptation plans and activities using a participatory approach that involves stakeholders from different sectors and levels.<br>• Assess the effectiveness of adaptation measures in reducing climate vulnerability and achieving desired outcomes.<br>**Learning from experience:**<br>• Identify lessons learned from the implementation of adaptation projects and use this information to improve future planning and implementation. | A 2 Obtain expert assistance<br>A 3 Data and information<br>A 8 Information infrastructure<br>A 13 State of the environment (coast), including social economy<br>A 14 Monitoring and evaluation<br>A 16 Plan and track NAP processng and evaluation<br>A 20 Adaptation success<br>A 22 Earth observation<br>A 23 Climate services |

ELEMENT F

# F Feedback

## Reporting

| STEPS | ACTIVITIES FOR COASTAL AND OCEAN ADAPTATION | SUPPLEMENTARY GUIDANCE | ACTIONS |
|---|---|---|---|
| **CONDUCT OUTREACH PROGRAMMES on the NAP process and report on progress and effectiveness** | • Disseminate the coastal and ocean adaptation documents and related outputs relevant stakeholders, as they become available. | **Stakeholder engagement:**<br>• Use existing or create coastal and ocean forums comprising stakeholders from national to local level to share adaptation progress.<br>• Provide structured feedback on the potential of the Blue Economy in a future climate.<br>**Strategic communication:**<br>• Develop a communication strategy for disseminating information about adaptation progress and effectiveness to different stakeholder groups.<br>• Utilize a variety of communication channels (e.g., websites, social media and community meetings) to reach diverse audiences. | A 6 Stakeholder action<br>A 8 Information infrastructure<br>A 10 Technical and scientific diplomacy<br>A 11 Capacity assessment |
| **NATIONAL REPORTING and communicating with societal stakeholders** | • Address coastal and ocean reporting to support the NAP mandate and relevant national policies. This may be aligned with other national management mechanisms such as ICZM and MSP, and Blue Economy strategies.<br>• Prepare a progress report on the implementation of coastal and ocean adaptation to support NAP reporting. | **Accessible communication materials:**<br>• Compile and contextualize coastal and ocean adaptation planning in an accessible format that can be shared and understood by different audiences, including policymakers, decision-makers, coastal managers, local authorities, communities and private sector companies.<br>• Translate technical information into plain language and visual formats that are easily understood by non-experts.<br>**Communication and dissemination strategy:**<br>• Develop a communication strategy for disseminating information about coastal and ocean adaptation to different stakeholder groups.<br>• Use a variety of communication channels (e.g., websites, social media and community meetings) to reach diverse audiences.<br>**Feedback and engagement:**<br>• Provide a mechanism for review and feedback, information sessions and public meetings, etc. | A 3 Data and information<br>A 8 Information infrastructure<br>A 13 State of the environment (coast), including social economy<br>A 16 Plan and track NAP process |
| **INTERNATIONAL REPORTING** | • Contribute information on coastal and ocean adaptation to regional platforms such as the UN Environmental Regional Seas programmes. | | A 3 Data and information<br>A 8 Information infrastructure<br>A 13 State of the environment (coast), including social economy<br>A 16 Plan and track NAP process |

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A 1-23

# Actions

## Table 13. Summary of coastal and ocean adaptation actions

| ACTIONS | DESCRIPTION |
|---|---|
| **A1 Risks** | Undertake and understand critical coastal and ocean climate change risks and vulnerability from the expected impacts. What, who and where are the risks? Systematically identify, assess and prioritize climate change risks and vulnerabilities specific to coastal LDCs. Analyse potential impacts on coastal ecosystems, communities, infrastructure and the Blue Economy to highlight priority areas and populations needing adaptation interventions. The aim is to mitigate the risks of climate change.<br>**Also consider:**<br>• **Ecosystem impact modelling:** Develop or use sophisticated models to project the specific impacts of climate change on key coastal ecosystems, enabling risk assessments and priority setting.<br>• **Participatory vulnerability mapping:** Conduct community-based mapping exercises to identify vulnerable areas and populations, ensuring local knowledge is integrated. |
| **A2 Obtain expert assistance** | Where there are immediate data, information, knowledge and capacity gaps, obtain expert advice from NGOs, academia and the research sector, United Nations bodies, UN4NAPS and regional organizations, etc. Secure technical expertise and knowledge from various sources (national, regional and international) to support NAP development and implementation. Enlist expertise in climate science, coastal engineering, ecosystem management, socio-economic assessment and adaptation planning to bridge knowledge gaps and improve effectiveness.<br>**Also consider:**<br>• **Climate-resilient infrastructure planning:** Develop practical guidelines for the climate-resilient design and construction of coastal infrastructure. This ensures that investments are protected from climate change impacts. |
| **A3 Data and information** | Ensure access to climate change data and information needed to plan adaptation and understand change in the future. This includes slow onset climate change and extreme event projections. What are the pathways by which climate change data and information can be sourced, interpreted and used? This also includes non-climate data needed to understand risk and vulnerabilities in coastal and ocean sectors, communities and infrastructure. An audit of data and information needs is critical, as is a strategy to fill gaps and obtain access. Value and source all types of data and information, including formal, scientific knowledge and local and Indigenous knowledge.<br>**Also consider:**<br>• **Data quality assurance:** Develop and implement rigorous quality control procedures for all coastal climate data used in NAP development. This ensures that all data used is accurate and reliable.<br>• **Climate projections downscaling:** Secure the resources required to downscale global climate models to generate reliable, localized coastal climate projections. This provides a baseline of reliable data to plan climate change adaptation in local areas.<br>• **FAIR data:** Making data and knowledge open and available for anyone to further validate and replicate so that data and products become trusted public goods. |
| **A4 Leverage networks** | Leverage the expertise, interests, willingness and resources from a broad-based network of stakeholders. This may include convening multi-agency teams at multiple levels of administration, NGOs and civil society within LDCs and from regional or international organizations and institutions. |

| ACTIONS | DESCRIPTION |
|---|---|
| **A5 Organize relationships** | Organize the contribution, input and support of a range of societal stakeholders, government agencies and the private sector. Create institutions to support coastal and ocean adaptation. Use existing coastal and ocean policies and the forums, committees and communities that are mandated or formed in association with ICZM, MSP, MPAs, local economic development and business chambers, etc. Define clear roles, responsibilities and communication channels between the stakeholders involved in NAP implementation. Ensure effective coordination and avoid duplication of effort for streamlined adaptation planning.<br>**Also consider:**<br>• **Inter-agency coordination mechanism:** Establish a committee or working group with representatives from relevant government agencies to coordinate coastal and ocean adaptation efforts, ensuring effective implementation. |
| **A6 Stakeholder action** | Invite support from different stakeholders across levels of administration and scales. National level strategic planning can be organized to inform local actions, interests and the use of available resources. People and organizations are important resources that can be organized, sometimes with low or no cost, to support adaptation actions for their own interest and benefit. Nurture approaches that value and include multiple sources of knowledge, including local and Indigenous knowledge. Promote the value of co-production, inclusion, equity and justice across scales.<br>**Also consider:**<br>• **Multi stakeholder consultation:** Establish a formal mechanism for ongoing consultation with government agencies, the private sector, civil society and local communities on coastal and ocean issues. This ensures that diverse perspectives are considered in adaptation planning.<br>• **Stakeholder mapping:** Create a visual aid to map relevant adaptation actors and their projects. This helps identify stakeholders that should be prioritized and those that are already making a significant change.<br>• **Social and environmental impact assessment:** Develop and apply a framework for assessing the potential social and environmental impacts of adaptation projects, ensuring sustainability and equity.<br>• **Community outreach programmes:** Implement impactful community outreach programmes to raise awareness about climate change and adaptation in coastal areas, empowering local communities. |
| **A7 Legal and policy advice** | Obtain legal advice on the use of existing legislation to support, underpin and mandate coastal and ocean adaptation. Policymaking or creating new legislation in the absence of supporting mechanisms for coastal and ocean adaptation requires legal and political support. Policy and legal advice may also be required to mesh existing legislation and policies, e.g., ICZM, MSP, MPAs and development plans, or resolve conflict where they present barriers to adaptation. |
| **A8 Information infrastructure** | Understand and be familiar with the sources of climate change and other data and information in LDCs. What data infrastructure exists? Freedom of information, data sharing agreements, data collection efforts, purchasing agreements, etc. may all be important to gain access and fill gaps in critical climate and non-climate data. Develop and maintain the infrastructure needed to effectively manage and disseminate climate-related data and information. Include databases, websites, communication systems and early warning systems for timely and accessible information.<br>**Also consider:**<br>• **Knowledge documentation:** Establish a robust system to document and validate local and traditional knowledge relating to coastal climate change. This ensures that those that are most exposed to the effects can contribute to climate adaptation planning. |

| ACTIONS | DESCRIPTION |
|---|---|
| **A 9** **UN4NAPS** | Structure a request for the most critical technical support required from the UN4NAPS initiative offered by the UNFCCC. Access technical guidance, financial assistance and capacity-sharing opportunities to support NAP development and implementation in LDCs. |
| **A 10** **Technical and scientific diplomacy** | Develop and nurture relationships with regional and international bodies, conventions and NGOs that can support coastal and ocean adaptation. Exchange data and information, support regional processes and contribute expertise where possible. |
| **A 11** **Capacity assessment** | Understand national through to local capacity (people, organizations and resources) to support coastal and ocean adaptation. Identify critical gaps in technical support (climate data analysis, climate service development, Earth observation analysis, risk and vulnerability assessment, co-production and communication, etc.) Design strategies to fill gaps in capacity and use opportunities for capacity development offered at the regional and international scale. Make every effort to retain national through to local experts, including local knowledge and networks.<br>**Also consider:**<br>• **Training programme development:** Design and implement training programmes to build the capacity of key stakeholders in coastal and ocean adaptation. Targeted training addresses identified skills gaps and equips stakeholders for effective adaptation implementation. |
| **A 12** **Policy decision** | Understand, promote and develop actions to adapt the Blue Economy or coastal and ocean sectors to climate change. Once there is agreement on the economic, social and ecological importance of coasts and oceans, the goods, services and ecosystem services provided can and should be embedded in policy to underpin the provision of financial and other resources. High-level policy support is required for applying for adaptation financing.<br>**Also consider:**<br>• **Alignment with national priorities:** Develop a robust mechanism for ensuring that coastal adaptation plans are fully aligned with overarching national development goals and sectoral strategies, for effective collaboration across sectors. |
| **A 13** **State of the environment (coast), including social economy** | Regular and systematic evaluation of the state of the coast and ocean provides important benchmark information against which adaptation progress can be measured. State of the coast reports offer multiple benefits across many important environmental themes associated with major challenges such as climate change, biodiversity loss and pollution.<br>**Also consider:**<br>• **Blue Economy assessment:** Thoroughly assess the Blue Economy's contribution to national GDP, employment and social well-being. This provides critical evidence for prioritizing coastal adaptation within national development planning.<br>• **Blue Economy vulnerability assessment:** Develop and apply specific tools to assess the vulnerability of key Blue Economy sectors to climate change, ensuring targeted adaptation for coastal communities and businesses.<br>• **Ecosystem services valuation assessment:** Quantify the economic value of ecosystem services provided by coastal and marine ecosystems (e.g., mangroves, coral reefs and fisheries). Demonstrating economic value strengthens the case for investing in coastal ecosystem conservation and adaptation. The use of ocean accounting frameworks can support the inclusion of information on social, economic and environmental in a standardized way consistent with national reporting frameworks. |

| ACTIONS | DESCRIPTION |
|---|---|
| **A 14** **Monitoring and evaluation** | Monitoring and evaluation and the iteration of the climate adaptation policy cycle is key to incremental adaptation and for opportunities and requirements for transformative change. Reporting on adaptation success and narrating positive adaptation outcomes, as well as identifying weaknesses or failure to adapt, are important to create momentum for future actions, requesting and securing financing and developing capacity.<br>**Also consider:**<br>• **Community-based monitoring programme:** Design and implement a participatory community-based monitoring programme for coastal and ocean adaptation, empowering local communities in data collection and reporting.<br>• **Adaptation of M&E framework:** Develop a framework for rigorously monitoring and evaluating the effectiveness of adaptation measures in achieving the desired outcomes, informing adaptive management. |
| **A 15** **Supplementary material** | Identify and use existing supplementary material to the NAP UNFCCC Technical Guidance. This may include requesting support from authors and organizations publishing supplementary material. |
| **A 16** **Plan and track NAP process** | Identify clear timelines for the planning and implementation of coastal and ocean adaptation. Understand and agree to the timeline of the adaptation implementation cycle, the rate of climate change and the timeframes for making policy interventions, securing political support and obtaining financial support.<br>**Also consider:**<br>• **Plan update process:** Establish a well-defined and documented process for regularly updating coastal and ocean adaptation plans to reflect new information, changing circumstances and lessons learned. |
| **A 17** **NAP and adaptation funding** | Secure a broad-based suite of coastal and ocean adaptation funding from global sources, national fiscus, the private sector and local communities. Develop realistic adaptation actions and expectations suited to the level of interventions. The private sector could contribute resources to maintain economic benefits from coastal and ocean resources and coastal communities may be able and willing to undertake no-regret, low-cost adaptation actions to support their livelihoods and well-being. |
| **A 18** **Cross-sectoral adaptation** | The coast and ocean as a management domain (ICZM, MSP and MPAs, etc.) is complex, with many invested economic sectors, levels of government and communities, etc. Coastal adaptation will require coordination among many, if not all sectors in a Blue Economy. Key sectors must be prioritized, but adaptation planning cannot be conducted within individual sectors. The flow of information, goods and services, skills and expertise between sectors is important for coastal and ocean adaptation.<br>**Also consider:**<br>• **Private sector engagement strategy:** Develop a clear and actionable strategy for engaging the private sector in identifying and implementing innovative adaptation solutions for the Blue Economy. |
| **A 19** **Nature-based solutions** | Employ NbS by preference. Understand the climate vulnerability of NbS, the cost of implementation and the sustainability of such solutions. Also establish the organizational networks and institutional support to establish, maintain and expand the use of NbS.<br>**Also consider:**<br>• **EbA implementation:** Actively support the implementation of EbA measures in coastal areas. This is a framework that allows projects to stay in line and implement using natural resources. |

| ACTIONS | DESCRIPTION |
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| **A 20**<br>**Adaptation success** | Develop a broad suite of indicators with which coastal and ocean adaptation success can be measured. Integrate these indicators in existing coastal and ocean policies linked to, e.g., ICZM, MSP and development planning. Regularly monitor and evaluate projects against these metrics to ensure desired outcomes are achieved.<br>**Also consider:**<br>• **Adaptation storytelling:** Find stories of how people are adapting to climate change and share them with communities for effective communication and to highlight success stories.<br>• **Effectiveness evaluation framework:** Develop a clear framework for evaluating the effectiveness of adaptation measures in reducing climate vulnerability and achieving desired outcomes.<br>• **Participatory review workshops:** Organize inclusive workshops to review adaptation plans and activities with a diverse range of stakeholders, ensuring broad participation and valuable feedback for continuous improvement.<br>• **Scalability assessment:** Develop a robust framework for assessing the potential scalability and replicability of adaptation actions across different coastal contexts and ecosystems. |
| **A 21**<br>**Adaptation options** | Select actions from ongoing coastal and ocean adaptation efforts that fit the national and local context. Develop more contextual adaptation options throughout the NAP development and implementation process.<br>**Also consider:**<br>• Adaptation options appraisal: Develop and apply a systematic framework for appraising and prioritizing adaptation options based on defined criteria, ensuring cost-effectiveness.<br>• **Cost–benefit analysis:** Apply cost–benefit analysis techniques for adaptation planning, facilitating informed decision-making on adaptation investments. |
| **A 22**<br>**Earth observation** | Make use of and embed Earth observation technology and services to plan, implement and evaluate adaptation options, actions, success and failure. Obtain expert advice and use many existing pathways to gain access to Earth observation products that provide meaning in the coastal and ocean adaptation context. |
| **A 23**<br>**Climate services** | Use climate services in all stages of the climate change adaptation cycle. Engage with climate services providers at the national and regional level, including meteorological offices or agencies, academia, NGOs and the private sector. Ensure the scientific robustness and quality of climate services before using them in the adaptation planning and implementation process.<br>**Also consider:**<br>• **Climate data visualization:** Create accessible and user-friendly visualizations of complex climate data and scenarios for various user groups. Such visualizations are intended for easy and accessible communication with all stakeholders involved in adaptation planning.<br>• **Communication materials development:** Create effective communication materials (brochures, videos and infographics) on coastal and ocean adaptation to raise awareness and promote action. |

Mozambique
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