



# Methodological frameworks for Regions and Destinations

for assessing the main coastal tourism-  
related issues concerning Climate Change

The Consortium:





<b>Project Information</b>	
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## Project Overview

The Mediterranean region is one of the most vulnerable hotspots in the current biodiversity and climate crises, warming 20% faster than the global average and being the second biodiversity hotspot in the world. The increase of severe climate events are also likely to influence the choice of destinations and time to travel for its over 510 million inhabitants. The effects of climate change will put additional pressure on already strained ecosystems and vulnerable economies and societies, with Tourism being one of the most affected economic sectors.

The recent Transition Pathway for Tourism and the Glasgow Declaration are building a global momentum for Climate Action in Tourism, but policymakers and destinations need support to better develop efficient climate mitigation and adaptation policies using ecosystem-based approaches and improved multi-level governance structures, including robust planning and ensure the long-term engagement of the private sector and citizens. Indeed, ecosystem-based management is considered a good practice to effectively deal with these threats as it considers the different stakeholders and factors affecting ecosystems and the mechanisms involved, in order to find solutions.

**NaTour4CChange** builds on and capitalises on successful experiences at the Mediterranean and global level to test solutions for increasing the resilience of coastal destinations in the Mediterranean. The project will aim to set common methods to allow participating regions to assess their tourism-related climate adaptation and mitigation priorities, and take climate action via plans and strategies, supported by cooperative governance.

In coastal destinations, cross-sector teams will deliver specific tourism climate Action Plans, focusing on climate adaptation, where Nature-based Solutions (NbS) will be tested to ensure their feasibility. At the same time, innovative destination marketing and communication approaches will engage private stakeholders, visitors, and residents in climate action.

The project will also ensure cross-fertilisation among participating regions and destinations, to achieve common methods and to compare the different tested plans and solutions, leading to lessons, best practices, and policy.



## Glossary

**Climate Change Adaptation (CCA)** means anticipating the adverse effects of climate change and taking appropriate measures to prevent or minimise the damage they may cause, or to take advantage of the opportunities that may arise.

**Climate Change Mitigation (CCM)** means making the impacts of climate change less severe by reducing the sources of emission of greenhouse gases (GHG) into the atmosphere or by improving the storage of these gases.

**Ecosystem Services (ES)** are the benefits that an ecosystem brings to society and that improve people's health, economy, and quality of life.

**Ecosystem-based Approaches (EbA)** focus on managing biodiversity and ecological systems in a holistic way to maintain and enhance ecosystem services benefits and functions.

**Nature-based Solutions (NbS)** encompasses all actions that rely on ecosystems and the services they provide to respond to various societal challenges such as climate change, food security, resource management, or disaster risk.

**Climate risk concept:** climate risk is potential for adverse impact on human and ecological systems because of dynamic interactions between climate-related hazards with the exposure and vulnerability.

**Climate-related hazard:** the potential occurrence of natural or human-induced physical events or trends that may cause adverse impacts on life, health, property, infrastructure, services and environmental capital.



# 1. INTRODUCTION

## 1.1 Objective within the Project Framework

The NaTour4CChange project, of which Plan Bleu is a partner, seeks to enhance the resilience and sustainability of coastal tourism destinations in the Mediterranean region through comprehensive climate action plans and strategies, with an ecosystem-based approach. This activity, coordinated by Plan Bleu, specifically aims to develop two methodological frameworks—one for the Regional level and another for the Destination level. These frameworks are designed to assess climate change adaptation and mitigation in coastal tourism, providing actionable, evidence-based guidelines to improve resilience and sustainability.

## 1.2 State of the Art: Tourism and Climate Change in the Mediterranean Region

The Mediterranean region, renowned for its rich biodiversity, cultural heritage, and attractive coastlines, is a prime destination for global tourism. However, it is also identified as a climate change hotspot, facing significant environmental and socio-economic challenges due to its high vulnerability to climate impacts. The following overview provides a snapshot of the current state of tourism and climate change in the Mediterranean, highlighting the key challenges and opportunities for adaptation and mitigation.

### 1.2.1 Climate Change Impacts on Tourism

Climate change profoundly affects the tourism sector in the Mediterranean through altered weather patterns, environmental degradation, and increased operational risks. Key impacts include:

1. **Temperature Rise and Precipitation Changes:** Elevated temperatures and changing precipitation patterns disrupt traditional tourism seasons and activities. For instance, rising temperatures and reduced snowfall threaten winter tourism destinations, shortening skiing seasons and increasing reliance on artificial snowmaking.
2. **Sea-Level Rise and Coastal Erosion:** Coastal tourism faces significant threats from sea-level rise, increasing the risks of flooding and coastal erosion. This directly impacts infrastructure and natural attractions, escalating maintenance and repair costs.
3. **Degradation of Marine Ecosystems:** Marine-based tourism activities, such as diving and snorkeling, are threatened by coral bleaching and ocean acidification, which diminish the attractiveness of marine ecosystems.



4. **Biodiversity Loss:** The loss of biodiversity and degradation of natural landscapes detract from the overall tourism experience, impacting visitor satisfaction and reducing the economic viability of destinations reliant on natural attractions.

### **1.2.2 Challenges in Adaptation and Mitigation**

Coastal tourism destinations in the Mediterranean face several critical challenges in adapting to climate change:

- **Financial Constraints:** Significant financial investments are required to upgrade infrastructure and cope with extreme weather events and rising sea levels. These investments are often beyond the reach of many destinations, particularly in developing regions.
- **Uncertainty in Climate Impacts:** The unpredictability of climate change impacts complicates effective planning and decision-making. The lack of accurate data and predictive models makes it challenging to formulate robust adaptation strategies.
- **Institutional and Governance Barriers:** Limited coordination and overlapping responsibilities among local authorities hinder cohesive climate strategies. Effective adaptation requires coordinated action across multiple governance levels and the engagement of diverse stakeholders.
- **Balancing Economic and Sustainability Goals:** Tourism businesses often prioritize immediate financial gains over long-term sustainability investments, delaying necessary adaptation measures. Integrating climate policies into existing tourism strategies is also challenging due to the sector's dependence on natural resources and climatic conditions.

### **1.2.3 Opportunities for Enhancing Climate Resilience**

Despite these challenges, there are several opportunities for enhancing climate resilience in coastal tourism:

- **Promoting Sustainable Practices:** Eco-tourism, advanced water-saving solutions in accommodations, seasonal water storage, and blue infrastructure (swimming pools, decorative pools, artificial ponds) can reduce environmental impacts and attract eco-conscious tourists. Extending tourist seasons in cooler regions can balance economic impacts.
- **Adaptive Management Strategies:** Flexible infrastructure that can withstand extreme weather and nature-based solutions, such as the restoration and management of coastal wetlands and lagoons, can protect shorelines and enhance biodiversity. *Posidonia Oceanica* plays a crucial role in carbon sequestration, while other nature-based solutions like dune restoration can help with the adaptation of the Mediterranean coast. Additionally, structural measures such as planning for different land uses in response to sea level changes, relocating coastal promenades and infrastructure, and installing raised wooden





beach elements can be considered. Soft measures, including education for adaptive management, local strategy development, monitoring, and fostering partnerships from government to local communities, are essential for comprehensive adaptive management.

- **Investing in Low-Carbon Technologies:** Renewable energy projects and energy-efficient technologies in tourist facilities can significantly reduce greenhouse gas emissions, aligning with global climate goals.
- **Strengthening Community Involvement:** Community-based tourism and local stakeholder engagement ensure that adaptation measures are culturally appropriate and widely supported, leading to more effective implementation.
- **Improving Governance:** Better coordination and stakeholder engagement are essential for effective climate strategies. Public-private partnerships can pool resources and knowledge to implement effective adaptation strategies.
- **Integrating Climate Considerations into Planning:** Ensuring that tourism development plans incorporate climate risk assessments can help destinations better prepare for and respond to climate impacts.

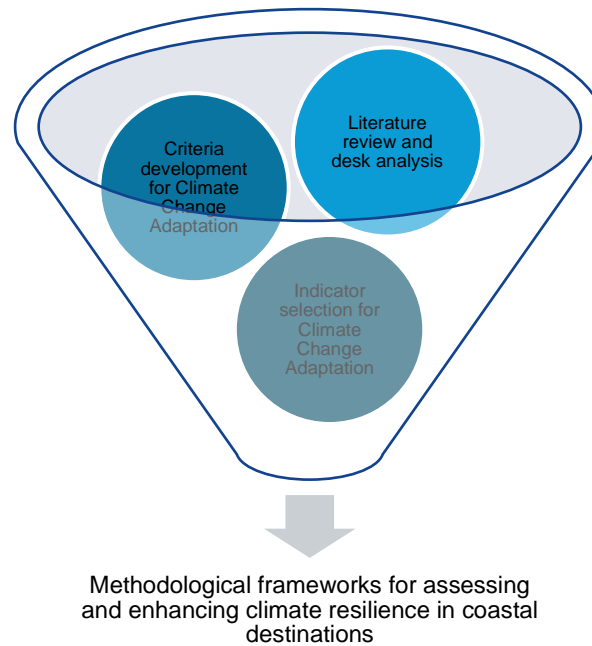
While the Mediterranean region faces significant challenges due to climate change, proactive adaptation and mitigation strategies can enhance the resilience and sustainability of its coastal tourism sector. By leveraging opportunities for sustainable practices, adaptive management, and improved governance, Mediterranean destinations can mitigate adverse climate impacts and ensure their long-term viability.

### 1.3 Implemented Methodology to develop the document

The activity employed a multi-faceted methodology across three key areas: *literature review*, *criteria development*, and *indicator selection*. Each of these components contributed to the creation of robust frameworks for assessing and enhancing climate resilience in coastal tourism.

#### 1- Literature Review and Desk Analysis:

- a. **Objective:** Establish a comprehensive knowledge base on climate change impacts on the tourism sector.
- b. **Process:** Conducted a systematic literature review, encompassing existing initiatives, projects, methodologies, and publications related to climate change and tourism. This analysis included recommendations from past Interreg Med projects, providing a solid baseline of knowledge that identifies key challenges, opportunities, and best practices.
- c. **Outcome:** A detailed understanding of the current landscape of climate change impacts on Mediterranean coastal tourism, informing the subsequent development of criteria and indicators.



**Figure 1.** Implemented methodology

## 2- Criteria Development for Climate Change Adaptation:

- a. **Objective:** Create a unified and adaptable set of criteria for assessing climate change adaptation strategies in tourism that are applicable at both regional and destination levels.
- b. **Process:**
  - i. **Stakeholder Identification and Engagement:** Involved local governments, tourism operators, environmental NGOs, community representatives, and academic experts to ensure diverse perspectives.
  - ii. **Needs Assessment and Gap Analysis:** Conducted survey to gather insights on current challenges and gaps.
  - iii. **Review of Existing Frameworks and Best Practices:** Analyzed current adaptation frameworks and successful case studies.
  - iv. **Development of Draft Criteria:** Synthesized insights to formulate an initial set of criteria.
  - v. **Stakeholder Validation and Refinement:** Iteratively refined the criteria based on stakeholder feedback.
- c. **Outcome:** A comprehensive set of criteria covering environmental sustainability, economic viability, socio-cultural integrity, governance, and resilience building.



### 3- Indicator Selection for Climate Change Adaptation:

- a. **Objective:** Develop a set of practical, measurable indicators tailored for the tourism sector to monitor adaptation efforts over time and across different geographical locations.
- b. **Process:**
  - i. **Systematic Literature Review:** Compiled indicators used in climate change adaptation, focusing on those relevant to tourism.
  - ii. **Expert Consultations:** Gathered insights from climate change and tourism experts to ensure practical applicability.
  - iii. **Engagement with Project Partners:** Facilitated discussions to align indicators with project objectives and capacities.
  - iv. **Alignment with CLIMATE-ADAPT:** Cross-referenced identified indicators with those listed on the CLIMATE-ADAPT platform.
  - v. **Indicator Refinement and Selection:** Refined the list based on feedback and practical considerations.
- c. **Outcome:** A curated set of indicators encompassing physical and environmental, economic, sociocultural, governance and policy, and biodiversity and ecosystem health dimensions.

This integrated methodology ensured that the developed frameworks are robust, evidence-based, and tailored to the specific needs of Mediterranean coastal tourism destinations and regions.



## 2. GENERAL METHODOLOGY FOR ASSESSING CLIMATE CHANGE IMPACTS AND DEVELOPING STRATEGIES

### 2.1 Methodology for Assessing Climate Change Impacts and Developing Strategies – Step-by-Step Guide

Developing a robust methodology for assessing climate change impacts is crucial for enhancing the resilience and sustainability of coastal tourism destinations and regions. The NaTour4CChange project focuses on building this resilience through comprehensive climate action plans and strategies. The following methodology outlines a structured approach for pilot destinations and regions to assess climate change impacts, characterize risks, and develop effective management strategies. This methodology is designed to provide actionable, evidence-based guidelines, ensuring that these areas can continue to thrive despite the challenges posed by climate change.

The rationale behind this methodology is to equip destinations and regions with the tools and knowledge necessary to understand and mitigate the impacts of climate change. Given the Mediterranean region's vulnerability to climate change, it is essential to develop a comprehensive framework that addresses both immediate and long-term risks. By involving diverse stakeholders, utilizing advanced tools such as GIS, and continuously monitoring and adjusting strategies, this approach aims to create a resilient tourism sector that can adapt to changing environmental conditions.

This methodology *should be implemented by a collaborative team comprising pilot regions/destination representatives, local government officials, tourism operators (businesses), environmental NGOs, and community representatives*. Regional authorities can provide overarching support and coordination, ensuring alignment with broader climate adaptation and mitigation goals.

#### **Step 1: Conducting a Comprehensive Climate Change Impact Assessment**

The first step involves a thorough baseline assessment to collect historical climate data and current climate observations. This includes analyzing past extreme weather events and their impacts on local ecosystems, infrastructure, and communities. Engaging stakeholders is crucial in this phase, as local communities, businesses, and governments can provide valuable insights into observed changes and impacts. Conducting workshops and surveys helps gather qualitative data on perceived vulnerabilities, ensuring a comprehensive understanding. Vulnerability mapping using GIS tools identifies sectors and populations at risk, creating visual representations of these vulnerabilities. Documenting and quantifying current impacts on ecosystems, economies, and health through local and regional studies validates findings and ensures accuracy.



1. **Baseline Assessment:**

- Collect historical climate data and current climate observations.
- Analyze past extreme weather events and their impacts on local ecosystems, infrastructure, and communities.

2. **Stakeholder Engagement:**

- Involve local communities, businesses, and governments in identifying observed changes and impacts.
- Conduct workshops and surveys to gather qualitative data on perceived changes and vulnerabilities.
- Engage diverse stakeholders to ensure diverse perspectives and comprehensive understanding.

3. **Vulnerability Mapping (see the box below):**

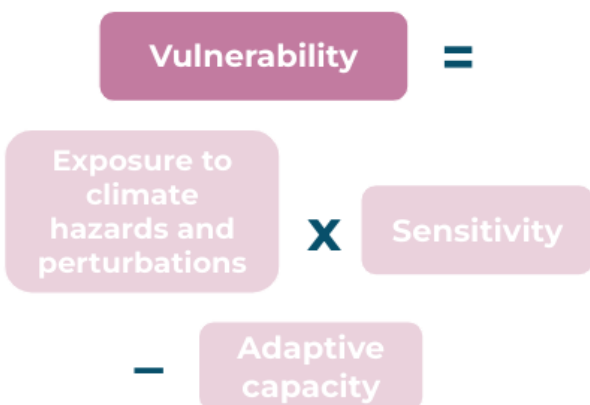
- Identify vulnerable sectors (e.g., agriculture, tourism, water resources) and populations (e.g., low-income groups, elderly).
- Use tools such as GIS to create vulnerability maps highlighting areas at risk.

4. **Current Impact Assessment:**

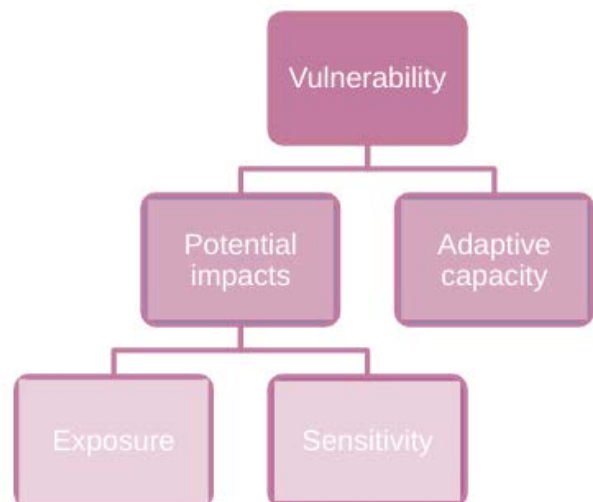
- Document and quantify current impacts on ecosystems, economies, and health using appropriate data, such as meteorological, hydrological, spatial data, and information on infrastructure and socio-economic challenges.
- Utilize local and regional studies to validate findings and ensure accuracy.

**Let's Focus on Vulnerability Mapping**

**What is Vulnerability?**



**How does it decompose?**



United National Development Programme. (2010). Mapping Climate Change Vulnerability and Impact Scenarios. A Guidebook for Sub-National Planners.

To determine and map the sensitivity of a territory, it requires to ask a series of guiding questions, which will help us to structure the assessment process:

**1. What are the projected hazards and perturbations under climate change?**

- ▶ What is likely to happen to temperature patterns (average and variance) in the future?
- ▶ What is likely to happen to rainfall events (average and variance) in the future?
- ▶ Are extreme events (such as droughts, floods, or cyclones) likely to increase in frequency and/or magnitude?
- ▶ What is likely to happen to sea level?

**2. What is the sensitivity to the projected hazards and perturbations?**

- ▶ How will existing sectors of society (population, agriculture, water, energy, tourism, fisheries, health,

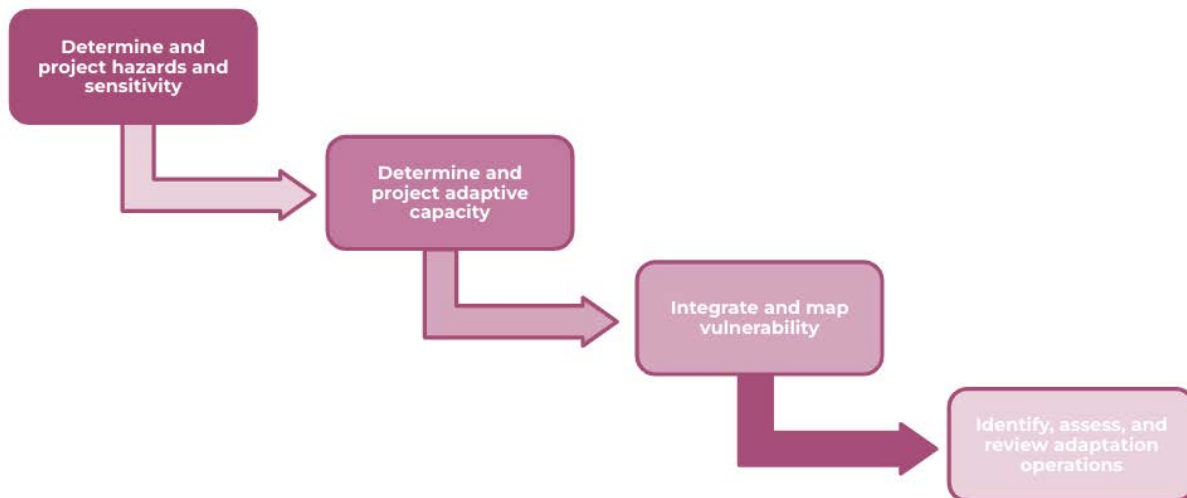
and biodiversity) be affected by these hazards and perturbations?

- ▶ Are there current socio-economic trends that interact with these sensitivities (and in particular run the risk of amplifying them)?

**3. What is the level of adaptive capacity?**

- ▶ How will society be able to cope with and manage these changes? Will they be able to make changes through policies and activities that minimize adverse impacts (or make the most of the opportunities presented)? Or will the expected changes increase their vulnerability?
- ▶ Can adaptation take place at sector level, or is there a need for more structural changes within society (e.g., economic diversification)?

**Key Steps for Mapping Vulnerability and Identifying Adaptation Options:**



**Step 2: Characterizing and Communicating Risk**

Understanding the dynamic nature of risk is essential. Climate hazards, exposure, and vulnerability change over time, influenced by socio-economic factors and decision-making. Applying IPCC-calibrated uncertainty and confidence language helps describe knowns and unknowns about potential adverse consequences<sup>1</sup>. This transparent

<sup>1</sup> The IPCC uses five confidence levels, ranging from very low to very high, indicated in italics (e.g., *medium confidence*). Likelihood of outcomes is expressed with terms such as virtually certain (99-100% probability),



assessment of uncertainties aids in effective communication. Using the hazard-exposure-vulnerability framework<sup>2</sup>, risks are assessed based on interactions between climate-related hazards and exposed systems. This framework ensures that assessments consider changes in exposure and vulnerability, not just the frequency and magnitude of hazards.

### 1. **Dynamic Nature of Risk:**

- Understand that risk is dynamic, influenced by changing climate hazards, exposure, and vulnerability over time.
- Recognize the role of socio-economic changes and decision-making in altering risk levels<sup>3</sup>.

### 2. **Uncertainty and Confidence:**

- Apply IPCC-calibrated uncertainty and confidence language to describe knowns and unknowns about potential adverse consequences.
- Provide a transparent assessment of uncertainties in climate projections, exposure, and vulnerability<sup>4</sup>.

### 3. **Hazard-Exposure-Vulnerability Framework<sup>5</sup>:**

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very likely (90-100%), likely (66-100%), more likely than not (>50-100%), about as likely as not (33-66%), unlikely (0-33%), very unlikely (0-10%), and exceptionally unlikely (0-1%). Additional terms like extremely likely (95-100%) and extremely unlikely (0-5%) are used as needed, also typeset in italics (e.g., *very likely*).

Source: [https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC\\_AR6\\_SYR\\_FullVolume.pdf](https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_FullVolume.pdf)

<sup>2</sup> Cardona, O. D., van Aalst, M. K., Birkmann, J., Fordham, M., McGregor, G., Perez, R., Pulwarty, R. S., Schipper, E. L. F., & Sinh, B. T. (2012). *Determinants of risk: Exposure and vulnerability*. In C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, K. J. Mach, G.-K. Plattner, S. K. Allen, M. Tignor, & P. M. Midgley (Eds.), *Managing the risks of extreme events and disasters to advance climate change adaptation* (pp. 65-108). Cambridge University Press.

[https://www.ipcc.ch/site/assets/uploads/2018/03/SREX-Chap2\\_FINAL-1.pdf](https://www.ipcc.ch/site/assets/uploads/2018/03/SREX-Chap2_FINAL-1.pdf)

<sup>3</sup> Vulnerability and risk assessments use diverse methods, from global indicator-based evaluations to local participatory approaches, each serving different objectives. Local participatory methods have been adapted to address climate change risks. Challenges include data scarcity and the complex dynamics of community capacities and vulnerabilities. Balancing sophisticated scientific inputs with simplicity and scalability is crucial. Guidance on assessing climate vulnerability and risk management at the community level is available in Chapter 5 of the IPCC's 2012 report: Intergovernmental Panel on Climate Change (IPCC). (2012). *Managing the risks of extreme events and disasters to advance climate change adaptation*. In C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, K. J. Mach, G.-K. Plattner, S. K. Allen, M. Tignor, & P. M. Midgley (Eds.), *A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

<sup>4</sup> The methods for risk and vulnerability assessments can be categorized into two types: top-down and bottom-up. Top-down methods rely on quantitative data, such as census data and downscaled climate models, and often involve mapping. Bottom-up methods utilize local knowledge to identify risks and are typically qualitative in nature. (Source: European Union, Climate-ADAPT. Retrieved from <https://climate-adapt.eea.europa.eu/en/knowledge/tools/urban-ast/step-2-4>).

<sup>5</sup> Cardona, O. D., van Aalst, M. K., Birkmann, J., Fordham, M., McGregor, G., Perez, R., Pulwarty, R. S., Schipper, E. L. F., & Sinh, B. T. (2012). *Determinants of risk: Exposure and vulnerability*. In C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, K. J. Mach, G.-K. Plattner, S. K. Allen, M. Tignor, & P. M. Midgley (Eds.), *Managing the risks of extreme events and disasters to advance climate change adaptation* (pp. 65-108). Cambridge University Press.

[https://www.ipcc.ch/site/assets/uploads/2018/03/SREX-Chap2\\_FINAL-1.pdf](https://www.ipcc.ch/site/assets/uploads/2018/03/SREX-Chap2_FINAL-1.pdf)



- Use this framework to assess risks resulting from climate-related hazards interacting with exposed and vulnerable systems.
- Ensure assessments include changes in exposure and vulnerability regarding current and future climate, not just hazard frequency and magnitude.

### **Step 3: Developing Risk Management Strategies**

Effective risk management strategies are developed by prioritizing feasible adaptation measures based on outlined criteria. These measures include nature-based solutions, infrastructure improvements, and policy changes. Establishing a monitoring system based on defined indicators tracks the effectiveness of implemented measures, allowing for adjustments based on monitoring results and new scientific findings. Promoting resilience through community engagement, education, and capacity building is crucial. Supporting diverse and flexible approaches enhances social, economic, and environmental resilience, ensuring long-term sustainability.

#### **1. Implement Adaptation Measures:**

- ***Based on the outlined criteria for CC adaptation and mitigation, develop and prioritize feasible strategies to reduce exposure and vulnerability (select the most relevant criteria P.24).***
- Include nature-based solutions, infrastructure improvements, and policy changes in adaptation plans.

#### **2. Monitoring and Evaluation:**

- ***Based on the indicators outlined, establish a monitoring system to track the effectiveness of implemented measures (select the most relevant indicators P.36).***
- Adjust strategies based on monitoring results and new scientific findings.

#### **3. Promote Resilience:**

- Foster resilience through community engagement, education, and capacity building.
- Enhance social, economic, and environmental resilience by supporting diverse and flexible approaches.





## 2.2 Purpose of the Criteria and Indicators

In the face of escalating climate vulnerabilities, particularly within the Mediterranean region, it is paramount to establish robust criteria and indicators for climate change adaptation and mitigation. These tools are designed to guide coastal tourism destinations in their efforts to address and adapt to the impacts of climate change, ensuring the sustainability and resilience of tourism activities.

The criteria provide a comprehensive framework for assessing and implementing adaptation and mitigation strategies at both the destination and regional levels. By focusing on localized strategies and broader regional coordination, the criteria help destinations address unique challenges while promoting cohesive strategies that enhance overall resilience.

The selected indicators provide critical insights into the impacts of climate change on tourism, aiding in formulating effective adaptation strategies. These indicators are essential for consistently tracking climate impacts, informing data-driven decision-making, and supporting policy development.

Policymakers should prioritize a set of mandatory indicators at both destination and regional levels to effectively guide climate change adaptation and mitigation in coastal tourism, ensuring sustainability and resilience. Additionally, incorporating optional indicators allows for a more nuanced understanding of specific climate risks and environmental conditions, enhancing targeted adaptation strategies. This balanced approach supports the development of robust, effective, and contextually relevant strategies that enhance the sustainability and resilience of Mediterranean coastal tourism.

The criteria and indicators are intrinsically linked, serving complementary roles in the assessment and implementation of climate adaptation and mitigation strategies. Criteria outline the key areas and specific goals for adaptation and mitigation efforts, providing a structured approach for destinations to follow. Indicators, on the other hand, offer measurable parameters that help track progress towards these goals, providing concrete data to inform decision-making and strategic planning.

For instance, criteria such as environmental sustainability, economic viability, and socio-cultural integrity are supported by specific indicators that measure relevant aspects like changes in annual temperature, tourism revenue variability, and community attitudes. This integration ensures that adaptation and mitigation efforts are both guided by clear objectives and supported by empirical data, facilitating continuous improvement and accountability.

The criteria and indicators are specifically designed to aid tourism destinations and regions in their climate action, ensuring they are relevant and effective. The reflection on their importance and the explanation of their rationale link both criteria and indicators to nature-based tourism development. This approach provides a framework for sustainable practices while offering concrete, measurable metrics to monitor progress. By emphasizing the critical role of natural ecosystems in enhancing resilience, it supports the implementation of Nature-based Solutions to address climate challenges at both destination and regional levels.



## 2.3 Selecting Relevant Criteria and Indicators

It is crucial for stakeholders to understand that not all criteria and indicators are equally relevant to every destination. The Mediterranean region encompasses a diverse range of coastal environments, each with unique characteristics and challenges. Therefore, stakeholders should prioritize the most relevant criteria and indicators based on their specific territorial contexts.

### Key Steps for Selection:

- **Assess Local Vulnerabilities and Strengths:** Identify the primary climate drivers and their induced direct and indirect impacts affecting the destination, such as temperature changes, sea-level rise, or extreme weather events. Consider local socio-economic conditions and environmental features that may influence - positively and/or negatively - the effectiveness of adaptation strategies.
- **Engage Stakeholders:** Involve local communities, tourism operators, policymakers, and other relevant parties in the selection process. Their insights and knowledge are crucial for understanding local needs and ensuring the acceptance and feasibility of selected criteria and indicators.
- **Align with Existing Frameworks:** Where possible, integrate new criteria and indicators with existing monitoring and evaluation systems. This alignment helps leverage current data and resources, facilitating smoother implementation and reducing redundancy.
- **Prioritize Feasibility and Impact:** Select criteria and indicators that are both practical to implement and likely to have a significant impact on enhancing resilience and sustainability. Consider resource availability, technical capacity, and potential barriers to implementation.
- **Iterative Review and Adaptation:** Regularly review and adjust the selected criteria and indicators based on new data, stakeholder feedback, and evolving climate conditions. This iterative process ensures that the adaptation and mitigation strategies remain effective and relevant over time.

By carefully selecting the most relevant criteria and indicators, stakeholders can tailor their adaptation and mitigation efforts to their specific needs and contexts, enhancing the overall resilience and sustainability of Mediterranean coastal tourism destinations. This targeted approach not only addresses immediate climate challenges but also supports long-term sustainability and economic viability in the face of changing climatic conditions.



## 3. ASSESSMENT MANUAL FOR REGIONS

### 3.1 Criteria Section

The criteria for assessing climate change mitigation and adaptation efforts are essential tools for regions to develop comprehensive and effective tourism strategies. These criteria provide a structured approach to ensure that all critical aspects of climate resilience and sustainability are addressed. Integrating these criteria into regional tourism strategies helps regions systematically evaluate their efforts, identify gaps, and implement targeted actions to mitigate and adapt to climate change. This integration ensures that climate considerations are embedded into the overall strategic planning process, making it easier to achieve long-term sustainability goals. The detailed process of criteria development is provided in Appendix 1.

#### How to Integrate Criteria into Strategic Planning:

1. **Align Goals and Objectives:** Regions should align their tourism goals and objectives with climate adaptation and mitigation criteria. This means setting clear, measurable targets related to reducing emissions, enhancing resilience, and protecting natural and cultural resources.
2. **Incorporate Criteria into Policy Frameworks:** Ensure that regional policies and regulations reflect the criteria. This can involve revising existing policies or creating new ones that support sustainable tourism practices and climate resilience.
3. **Engage Stakeholders:** Involve a broad range of stakeholders, including local communities, tourism operators, and policymakers, in the planning process. Their input ensures that the criteria are relevant and actionable.
4. **Develop Action Plans:** Create detailed action plans that outline specific steps to meet the criteria. These plans should include timelines, responsible parties, and required resources.
5. **Monitor and Evaluate Progress:** Use the criteria as benchmarks to regularly monitor and evaluate progress. This helps in identifying areas for improvement and adjusting strategies as needed.

#### Criteria for Mitigation Efforts:

Regions should focus on promoting renewable energy, improving energy efficiency, and encouraging sustainable transportation options. Implementing sustainable practices, such as sustainable agriculture and improved waste management, helps minimize environmental impact. Creating a supportive regulatory environment through the development and enforcement of climate policies and providing economic incentives for sustainable practices is crucial. Engaging the community in climate action through public awareness campaigns and fostering stakeholder collaboration ensures broader support and participation.



### Criteria for Adaptation Efforts:

Protecting and enhancing natural ecosystems involves monitoring environmental changes, using flexible and reversible measures, and promoting soft engineering solutions. Ensuring economic resilience requires developing cost-effective adaptation measures, building climate-resilient infrastructure, and creating rapid recovery plans. Maintaining socio-cultural integrity means involving local communities in planning, increasing public education and awareness, and integrating traditional knowledge into adaptation strategies. Strengthening institutional frameworks includes incorporating climate change into tourism planning, enhancing crisis management, and developing supportive policies and regulations. Building resilience involves promoting flexible infrastructure and providing financial incentives and climate services. Efficient water management can be achieved through water-saving technologies, wastewater reuse, and conservation programs.

## 3.2 Indicators Section

Indicators are essential for measuring the progress and effectiveness of climate change mitigation and adaptation efforts. By integrating these indicators into regional tourism strategies, regions can monitor their performance, track changes over time, and make data-driven decisions to improve their resilience and sustainability. These indicators provide a comprehensive overview of the region's climate-related challenges and successes, helping to inform policy adjustments and strategic planning. The detailed process of indicator development is provided in Appendix 2.

### How to Integrate Indicators into Strategic Planning:

1. **Define Key Indicators:** Identify key indicators from the list that align with the region's strategic objectives and criteria.
2. **Set Baselines and Targets:** Establish baseline data for each indicator and set realistic targets. This provides a starting point for measuring progress.
3. **Incorporate Indicators into Monitoring Frameworks:** Integrate these indicators into existing monitoring and evaluation frameworks. This ensures that data collection and analysis are systematic and consistent.
4. **Regular Reporting:** Use indicators to produce regular progress reports. These reports should be shared with stakeholders to maintain transparency and accountability.
5. **Adjust Strategies Based on Data:** Use the data collected through indicators to make informed decisions and adjust strategies as needed. This helps in responding to new challenges and opportunities effectively.

### Indicators for Mitigation Efforts:

Renewable energy usage rates, improvements in energy efficiency, and reductions in tourism-related emissions should be measured. Indicators should also track the adoption of sustainable agriculture practices, waste management efficiency, and



resource consumption levels. Policy and legislation indicators include the number of climate policies implemented, economic incentives provided, and alignment with national and international standards. Community engagement and education indicators should measure public awareness levels, the frequency of stakeholder collaboration, and the integration of community feedback.

### **Indicators for Adaptation Efforts:**

Environmental sustainability indicators include changes in annual temperature, the frequency of hot days, and sea-level rise data. Economic viability indicators track tourism revenue variability, the cost of climate adaptation, and economic recovery speed post-climate events. Socio-cultural integrity indicators assess tourist satisfaction levels, local community attitudes towards tourism, and the effectiveness of public awareness campaigns. Governance and policy support indicators measure the implementation of climate adaptation policies, funding for adaptation projects, and crisis management effectiveness. Resilience building indicators include infrastructure flexibility and removability, financial incentives for adaptation, and the availability of climate services. Sustainable water use indicators track water usage efficiency, wastewater reuse rates, and the success of conservation programs.



## 4. ASSESSMENT MANUAL FOR DESTINATIONS

### 4.1 Criteria Section

The criteria for assessing climate change adaptation efforts are essential for destinations to create robust tourism strategies that address climate risks. These criteria help destinations systematically evaluate their adaptation efforts, ensuring all critical areas are covered. By integrating these criteria into tourism strategies, destinations can enhance their resilience, protect their unique natural and cultural assets, and secure the long-term sustainability of their tourism industry.

#### How to Integrate Criteria into Strategic Planning:

1. **Align Destination Goals:** Ensure that the destination's tourism goals align with climate adaptation criteria. This includes setting targets for environmental sustainability, economic resilience, and socio-cultural integrity.
2. **Revise Policies and Practices:** Incorporate the criteria into local policies and tourism management practices. This may involve updating existing policies or creating new ones that support sustainable tourism and climate resilience.
3. **Engage Local Stakeholders:** Involve local communities, tourism operators, and other stakeholders in the planning process. Their involvement ensures the criteria are relevant and that there is local buy-in.
4. **Develop Detailed Plans:** Create action plans that detail specific steps to meet the criteria, including timelines and responsible parties.
5. **Monitor and Evaluate:** Regularly monitor progress against the criteria and make adjustments as needed to ensure continuous improvement.

#### Criteria for Adaptation Efforts:

Destinations should focus on protecting and enhancing natural ecosystems by monitoring environmental changes, using flexible and reversible measures, and promoting soft engineering solutions. Ensuring economic resilience involves developing cost-effective adaptation measures, building climate-resilient infrastructure, and creating rapid recovery plans. Maintaining socio-cultural integrity means involving local communities in planning, increasing public education and awareness, and integrating traditional knowledge into adaptation strategies. Strengthening institutional frameworks includes incorporating climate change into tourism planning, enhancing crisis management, and developing supportive policies and regulations. Building resilience involves promoting flexible infrastructure and providing financial incentives and climate services. Efficient water management can be achieved through water-saving technologies, wastewater reuse, and conservation programs.



## 4.2 Indicators Section

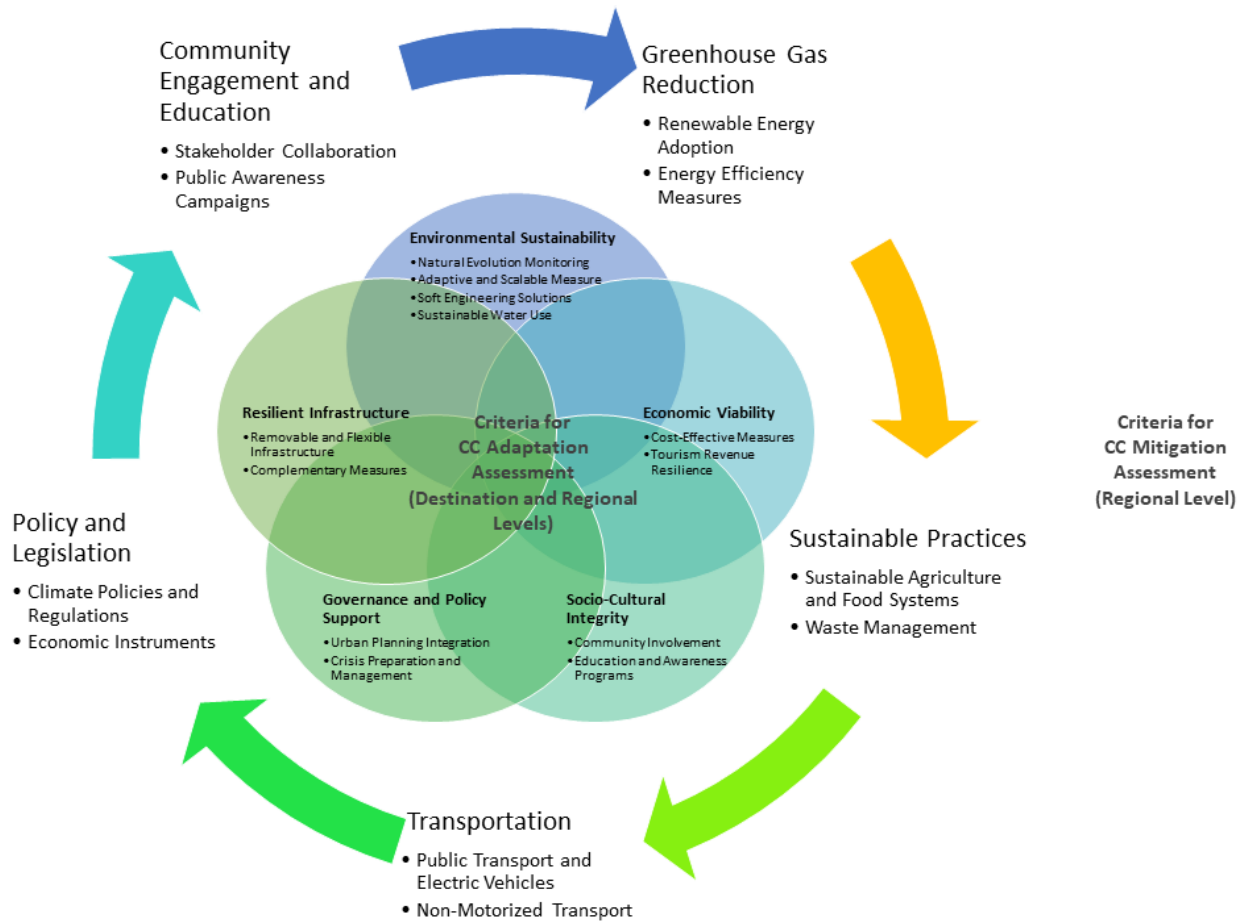
Indicators are vital for measuring the effectiveness of climate change adaptation efforts at the destination level. By integrating these indicators into tourism strategies, destinations can monitor their progress, identify areas for improvement, and make informed decisions to enhance their resilience and sustainability. These indicators provide valuable insights into the destination's climate-related challenges and achievements, guiding continuous improvement in adaptation efforts.

### How to Integrate Indicators into Strategic Planning:

1. **Identify Key Indicators:** Select indicators from the list that reflect the destination's strategic objectives and adaptation criteria.
2. **Establish Baselines:** Gather baseline data for each indicator to provide a reference point for measuring future progress.
3. **Integrate into Monitoring Systems:** Incorporate the indicators into the destination's existing monitoring and evaluation systems to ensure consistent data collection and analysis.
4. **Regular Reporting:** Use the indicators to produce regular progress reports. Share these reports with stakeholders to ensure transparency and foster trust.
5. **Use Data for Improvement:** Analyze the data collected through indicators to identify trends, assess the effectiveness of current strategies, and make necessary adjustments.

### Indicators for Adaptation Efforts:

Environmental sustainability indicators include changes in annual temperature, the frequency of hot days, and sea-level rise data. Economic viability indicators track tourism revenue variability, the cost of climate adaptation, and economic recovery speed post-climate events. Socio-cultural integrity indicators assess tourist satisfaction levels, local community attitudes towards tourism, and the effectiveness of public awareness campaigns. Governance and policy support indicators measure the implementation of climate adaptation policies, funding for adaptation projects, and crisis management effectiveness. Resilience building indicators include infrastructure flexibility and removability, financial incentives for adaptation, and the availability of climate services. Sustainable water use indicators track water usage efficiency, wastewater reuse rates, and the success of conservation programs.



**Figure 2.** Integration of Criteria for Climate Change Adaptation Assessment (Destination and Regional Levels) and Climate Change Mitigation Assessment (Regional Level)





## 5. DEVELOPED CRITERIA AND INDICATORS FOR REGIONS AND DESTINATIONS

### 5.1 Criteria for CC Mitigation Assessment (Regional Level)

To effectively address climate change mitigation in coastal tourism, a set of criteria focused on key areas such as greenhouse gas reduction, sustainable practices, transportation, policy and legislation, and community engagement and education has been proposed. These criteria are based on comprehensive analysis and best practices from successful global case studies and have been specifically tailored to the Mediterranean region through extensive stakeholder surveys.

These criteria are designed to be practical and adaptable, suitable for both individual tourism destinations and broader regional initiatives. By focusing on these critical areas, we provide a robust framework that guides tourism operators, local governments, and communities in reducing emissions and promoting sustainability. This structured approach ensures a cohesive and comprehensive strategy for mitigating the impacts of climate change, enhancing the resilience and sustainability of Mediterranean coastal tourism. By implementing these criteria, policymakers can help ensure that tourism destinations in the Mediterranean are well-prepared to meet climate challenges while maintaining economic and environmental sustainability.

#### 1. Greenhouse Gas Reduction

##### *Renewable Energy Adoption*

**Definition and Importance:** Promoting the use of solar, wind, and other renewable energy sources to reduce dependence on fossil fuels is critical for lowering greenhouse gas emissions. Transitioning to renewable energy helps mitigate climate change by reducing the carbon footprint of tourism operations.

**Key Components:**

- Installing solar panels and wind turbines in tourism facilities.
- Providing incentives for renewable energy projects.
- Integrating renewable energy systems into local and regional energy grids.

**Examples of Best Practices:**

- Increase the use of renewable energy sources such as solar, wind, and biomass to reduce dependence on fossil fuels and decrease CO<sub>2</sub> emissions in Sardinia, Italy.
- Wind farms in coastal Spain that supply renewable energy to nearby tourist destinations.



## *Energy Efficiency Measures*

**Definition and Importance:** Implementing energy-saving technologies and practices in buildings, transport, and tourism operations is essential for reducing energy consumption and greenhouse gas emissions. Enhanced energy efficiency contributes to both environmental sustainability and cost savings.

**Key Components:**

- Retrofitting buildings with energy-efficient lighting, heating, and cooling systems.
- Promoting the use of energy-efficient appliances and machinery.
- Implementing energy management systems to monitor and reduce consumption.

**Examples of Best Practices:**

- The Green Key certification program recognizes hotels and tourism facilities that implement energy-efficient practices.
- Upgrading to more energy-efficient lighting and HVAC systems (heating, ventilation, and air conditioning), implementing smart room technologies, and using renewable energy sources like solar panels in hotels can lead to cost savings in the long run and attract sustainability-conscious guests.

## **2. Sustainable Practices**

### *Sustainable Agriculture and Food Systems*

**Definition and Importance:** Encouraging practices that reduce emissions from agricultural activities and promote local food sourcing help minimize the carbon footprint associated with food production and transportation. Sustainable agriculture supports local economies and enhances food security.

**Key Components:**

- Promoting organic farming and reduced use of chemical fertilizers.
- Encouraging local food sourcing and farm-to-table initiatives in tourism.
- Implementing practices that enhance soil health and carbon sequestration.

**Examples of Best Practices:**

- Farm-to-table programs that provide restaurants and hotels with fresh, locally sourced food.
- Organic farming initiatives reduce agricultural emissions and support local biodiversity and livelihoods.



## *Waste Management*

**Definition and Importance:** Improving waste management practices to minimize methane emissions and promote recycling and reduction of single-use plastics is vital for reducing the environmental impact of tourism activities. Effective waste management contributes to cleaner environments and lower greenhouse gas emissions.

### **Key Components:**

- Implementing comprehensive recycling programs in tourism facilities.
- Reducing the use of single-use plastics through bans and alternatives.
- Managing organic waste through composting and anaerobic digestion.

### **Examples of Best Practices:**

- Zero Waste initiatives that promote recycling and composting in hotels, restaurants, and tourist attractions.
- The elimination of single-use plastics in the hospitality industry by providing reusable alternatives.

## **3. Transportation**

### *Public Transport and Electric Vehicles*

**Definition and Importance:** Encouraging the use of public transportation and the adoption of electric vehicles reduce emissions from tourism-related transport. Sustainable transportation options are crucial for lowering the carbon footprint of tourism activities.

### **Key Components:**

- Expanding and improving public transportation networks.
- Providing incentives for the use of electric vehicles, including charging infrastructure.
- Promoting car-sharing programs and electric bike rentals.

### **Examples of Best Practices:**

- The introduction of electric buses and trams to serve tourists and locals.
- The widespread availability of e-bike share systems supports sustainable mobility within the destinations.



### *Non-Motorized Transport*

**Definition and Importance:** Developing infrastructure to support cycling, walking, and other non-motorized modes of transport encourages low-emission travel and enhances the tourist experience. Non-motorized transport reduces traffic congestion and pollution while promoting health and well-being.

**Key Components:**

- Building and maintaining bike lanes and pedestrian pathways.
- Implementing bike-sharing programs and pedestrian-friendly zones.
- Promoting non-motorized transport through tourism marketing and incentives.

**Examples of Best Practices:**

- The extensive bike-sharing program in Paris, known as Vélib', which offers tourists an eco-friendly way to explore the city.
- The pedestrian-friendly zones and walking tours in historic cities like Florence, Italy, reduce vehicle traffic and emissions.

## **4. Policy and Legislation**

### *Climate Policies and Regulations*

**Definition and Importance:** Developing and enforcing policies that limit emissions and promote sustainable practices across the tourism sector is essential for achieving long-term climate goals. Effective policies provide a regulatory framework that drives sustainable behaviour.

**Key Components:**

- Establishing emission reduction targets and standards for tourism businesses.
- Enforcing regulations that require energy efficiency and sustainable practices.
- Supporting policies that promote renewable energy and sustainable transport.

**Examples of Best Practices:**

- Encouraging hospitality businesses' certification aligned with GSTC criteria<sup>6</sup> promotes the adoption of green practices.

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<sup>6</sup> Global Sustainable Tourism Council. (2024). GSTC criteria. Retrieved from <https://www.gstccouncil.org/gstc-criteria/>



## *Economic Instruments*

**Definition and Importance:** Utilizing carbon pricing, taxes, and subsidies to incentivize emission reductions and sustainable practices aligns economic interests with environmental goals. Economic instruments make it financially attractive to adopt green practices.

**Key Components:**

- Implementing carbon pricing mechanisms, such as carbon taxes or cap-and-trade systems.
- Providing subsidies and tax incentives for renewable energy projects and energy-efficient upgrades.
- Offering grants and low-interest loans for sustainability initiatives in tourism.

**Examples of Best Practices:**

- The carbon taxes could encourage businesses, including tourism operators, to reduce their carbon emissions<sup>7</sup>.
- Subsidies for solar energy installations could promote renewable energy use in the tourism sector<sup>8</sup>.

## **5. Community Engagement and Education**

### *Stakeholder Collaboration*

**Definition and Importance:** Fostering partnerships between local communities, governments, and tourism operators to support and implement mitigation strategies ensures a coordinated and inclusive approach. The collaboration leverages diverse expertise and resources for greater impact.

**Key Components:**

- Establishing multi-stakeholder committees and working groups.
- Facilitating regular meetings and communication channels for stakeholders.
- Sharing best practices and resources to support joint mitigation efforts.

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<sup>7</sup> World Bank. "Pricing Carbon." World Bank. Available: <https://www.worldbank.org/en/programs/pricing-carbon>.

World Bank. "State and Trends of Carbon Pricing 2023." World Bank. Available: <https://openknowledge.worldbank.org/entities/publication/58f2a409-9bb7-4ee6-899d-be47835c838f>

<sup>8</sup> European Commission. (2024). EU renewable energy financing mechanism. Retrieved from [https://energy.ec.europa.eu/topics/renewable-energy/financing/eu-renewable-energy-financing-mechanism\\_en](https://energy.ec.europa.eu/topics/renewable-energy/financing/eu-renewable-energy-financing-mechanism_en)

**Examples of Best Practices:**

- The collaborative approach where stakeholders work together to protect the heritage from climate impacts.
- Community-based tourism initiatives where local communities participate in sustainable tourism planning and implementation.

*Public Awareness Campaigns*

**Definition and Importance:** Conducting educational programs to raise awareness about the importance of reducing greenhouse gas emissions and adopting sustainable practices ensure that all stakeholders are informed and motivated to contribute to climate action. Awareness campaigns build a culture of sustainability.

**Key Components:**

- Developing and distributing educational materials on climate change and sustainability.
- Organizing workshops, seminars, and public events to engage and educate the community.
- Utilizing media and social platforms to reach a broader audience.

**Examples of Best Practices:**

- The "Leave No Trace" campaign in New Zealand, educating tourists on minimizing their environmental impact.
- Climate change education programs, such as "Eco-School" in Seychelles, inform tourists and locals about sustainable practices and resilience measures.

## 5.2 Criteria for Adaptation Assessment (Destination and Regional Levels)

The criteria for climate change adaptation at the regional and destination levels have been carefully crafted to tackle the specific challenges faced by coastal tourism destinations. These criteria cover five key areas such as environmental sustainability, economic viability, socio-cultural integrity, governance and policy support and resilience building

These criteria are based on successful global adaptation strategies and best practices and have been tailored to the Mediterranean context through comprehensive stakeholder surveys. They provide a detailed framework to guide tourism operators, regional and local governments, and communities in enhancing their ability to adapt to climate change. The focus on these critical areas ensures that adaptation measures are both practical and effective, addressing the specific needs and contexts of Mediterranean coastal destinations. This structured approach ensures that all aspects of



adaptation—from environmental monitoring to community involvement and policy integration—are thoroughly addressed. This framework not only supports immediate adaptive actions but also promotes long-term sustainability and resilience. It provides a solid foundation for maintaining the viability and attractiveness of coastal tourism in the face of climate change, ensuring that these destinations and regions can continue to thrive despite environmental challenges.

## 1. Environmental Sustainability

### *Natural Evolution Monitoring*

**Definition and Importance:** Implementing and maintaining surveillance networks to track physical processes and ecological changes is crucial for understanding and responding to the dynamic coastal environment. Continuous monitoring helps detect early signs of environmental stress, facilitating timely interventions.

**Key Components:**

- Establishing a monitoring plan by implementing a network of sensors and observation points (depending on destination).
- Regularly collecting and analyzing data on coastal environmental processes and related ecological health.
- Integrating monitoring results into decision-making processes.

**Examples of Best Practices:** The Mediterranean Integrated Coastal Zone Management (ICZM) Protocol<sup>9</sup> includes extensive monitoring of coastal dynamics to guide sustainable development.

### *Adaptive and Scalable Measures*

**Definition and Importance:** Adaptation measures that can be easily reversed or adjusted without significant financial impact ensure that strategies remain effective as conditions change. This flexibility is crucial for managing uncertainty and reducing long-term risks.

**Key Components:**

- Designing infrastructure and policies that allow for adjustments.
- Regularly reviewing and updating measures based on new data and changing conditions.

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<sup>9</sup> Priority Actions Programme Regional Activity Centre (PAP/RAC). (2024). ICZM Protocol. UNEP MAP. Retrieved from <https://paprac.org/iczm-protocol>



- Developing solutions that can be scaled up or down based on the severity of climate impacts and available resources.

**Examples of Best Practices:** Reversible land-use policies in the Netherlands that allow for temporary agricultural use of flood-prone areas.

### *Soft Engineering Solutions<sup>10</sup>*

**Definition and Importance:** Promoting beach nourishment and ecological engineering methods to stabilize beaches and dunes leverages natural processes to enhance coastal resilience. These methods are less intrusive and more sustainable compared to hard engineering solutions.

**Key Components:**

- Adding sand to eroding beaches to restore their profiles sustainably.
- Ecological restoration by using vegetation and other natural biomaterials to stabilize dune cordons and prevent erosion.

**Examples of Best Practices:**

- The beach nourishment programs in some Med countries (e.g., Italy) contributed to successfully restoring eroded beaches and improving coastal resilience.
- The use of vertical bundles of heather wood in the chestnut wood structure and coconut roll filled with sand increase the resistance and resilience of coastal dunes against erosion in the Italian region of Tuscany.

### *Sustainable Water Use*

**Definition and Importance:** Implementing strategies for the efficient use and management of water resources is essential for sustaining tourism activities, especially in regions prone to water scarcity. Sustainable water use practices ensure that the demand for water does not exceed the supply, protecting both natural ecosystems and tourism operations.

**Key Components:**

- Tackling the balanced distribution (between activity sectors) of the water resources.

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<sup>10</sup> Soft engineering solutions utilize natural processes and materials to protect and enhance coastal areas. These measures are less intrusive and more sustainable compared to traditional hard engineering solutions, offering a flexible and environmentally friendly approach to managing coastal resilience and adaptation. (e.g. Adding sand to beaches to combat erosion and maintain beach width and planting vegetation to stabilize dunes and protect against flooding. Using natural elements to stabilize the coast, provide habitat, and to control erosion.)





- Installing water-saving technologies such as low-flow fixtures and irrigation systems.
- Promoting the reuse of treated wastewater for landscaping and other non-potable uses.
- Implementing water conservation programs and incentives for reducing water use.

**Examples of Best Practices:**

- The use of greywater systems in hotels for irrigation purposes.
- Water conservation campaigns that encourage both tourists and residents to reduce water consumption.

## 2. Economic Viability

### *Cost-Effective Measures*

**Definition and Importance:** Prioritizing adaptation strategies that offer high impact with manageable costs ensures that resources are used efficiently. Cost-effective measures provide significant benefits without imposing excessive financial burdens on communities and businesses.

**Key Components:**

- Evaluating the cost-benefit ratio of different adaptation options.
- Implementing measures that provide immediate and long-term economic benefits.

**Examples of Best Practices:** The dune management program in the Netherlands, which uses cost-effective sand replenishment to maintain coastal defences.

### *Tourism Revenue Resilience*

**Definition and Importance:** Ensuring tourism activities and infrastructure can withstand and quickly recover from climate-related disruptions is essential for maintaining the economic stability of tourism-dependent areas. Resilient tourism infrastructure supports continued visitor engagement and revenue generation.

**Key Components:**

- Designing and retrofitting infrastructure to be climate resilient.
- Developing rapid response and recovery plans for tourism businesses.



### Examples of Best Practices:

- The resilient design of the tourism facilities, which includes elevated structures and flexible operations to handle extreme weather events.
- A Tourism Crisis Management Plan and a Crisis Communication Strategy in Greece covers a wide range of potential crises that can impact tourism, including health, environmental, economic, and societal crises

## 3. Socio-Cultural Integrity

### *Community Involvement*

**Definition and Importance:** Engaging local communities in adaptation planning and implementation ensures that their needs and knowledge are integrated into strategies. Community involvement fosters ownership and enhances the relevance and acceptance of adaptation measures.

#### **Key Components:**

- Including community representatives in planning and decision-making processes.
- Conducting regular consultations and feedback sessions with local residents.

#### **Examples of Best Practices:**

- A participatory coastal management approach in Bari, Italy, involves the local community in decision-making processes.
- Community-led dune restoration projects in the Region of Tuscany, Italy. The intervention involved planting 600 trees and 16,000 herbaceous and shrub plants, closing 130 paths on the dune, and opening 50 environmentally sustainable accesses.

### *Education and Awareness Programs*

**Definition and Importance:** Raising awareness among tourists and locals about climate risks and adaptation strategies through targeted sensibilization campaigns fosters a culture of resilience and proactive adaptation. Education programs help stakeholders understand the importance of adaptation measures and how they can contribute.

#### **Key Components:**

- Developing and disseminating educational materials on climate risks and adaptation strategies.



- Organizing workshops, seminars, and awareness campaigns for different stakeholder groups.

**Examples of Best Practices:**

- The Mission for Natural Heritage releases an awareness campaign aiming to share knowledge about the causes and effects of coastal erosion, as well as solutions proposed or already put in place, engaging citizens from shore to shore all along the Mediterranean basin.
- The Caribbean Tourism Organization launched a Regional Tourism Education and Awareness Campaign to foster a discussion on climate resilience and sustainability on both the regional and international stage.

#### 4. Governance and Policy Support

##### *Urban Planning Integration*

**Definition and Importance:** Incorporating climate change adaptation considerations into local urban planning and development regulations ensures that future developments are resilient to climate impacts. Urban planning integration helps avoid maladaptation and promotes sustainable growth.

**Key Components:**

- Revising zoning laws and building codes to include climate resilience criteria.
- Ensuring new developments undergo climate impact assessments.

**Examples of Best Practices:**

- The climate-resilient urban planning framework in Rotterdam, which includes flood-proof building designs and green infrastructure.
- Barcelona's green urban planning initiatives, which incorporate climate adaptation measures into city development projects.

##### *Crisis Preparation and Management*

**Definition and Importance:** Enhancing the resilience of communities through comprehensive disaster preparedness and response plans is vital for protecting both residents and tourists from climate-related hazards. Effective crisis management minimizes damage and speeds up recovery.

**Key Components:**

- Developing and regularly updating disaster response plans.



- Conducting drills and training programs for emergency response teams.

#### **Examples of Best Practices:**

- Portugal undertook an ambitious process to develop a new integrated wildland fire management plan with the goal of protecting Portugal from severe wildland fires.
- Spain has introduced the National Climate Change Adaptation Plan (PNACC) 2021-2030 – the basic planning instrument to promote coordinated action against the effects of climate change in Spain. Its main objective is to avoid or reduce present and future damage from climate change and to build a more resilient economy and society.

## **5. Resilient Infrastructure**

### *Removable and Flexible Infrastructure*

**Definition and Importance:** Promoting the construction of infrastructure and facilities (public, transportation, tourism-related) that can be easily moved or adapted in response to changing environmental conditions, as well as the systems for increasing efficiency of water and energy use, provides long-term resilience. Flexible infrastructure minimizes the risk of damage and reduces operational and recovery costs.

#### **Key Components:**

- Designing modular and movable buildings.
- Implementing infrastructure that can be easily adapted or relocated as needed.
- Implementing systems for reducing energy and water consumption, along with rainwater collection and green and blue infrastructure.

#### **Examples of Best Practices:**

- Floating houses in the Netherlands, designed to rise with water levels during floods.
- Artificial reefs, which can be set offshore or on the foreshore, reduce wave energy on the beaches behind them, slow down long-shore drift, favor foreshore growth to limit erosion, and function like submerged breakwaters, often made from materials such as geotextile, sand, large blocks, concrete, or pit run material.

### *Complementary Measures*

**Definition and Importance:** Implementing financial incentives, climate services, and information systems supports adaptation efforts and encourages proactive



engagement from all stakeholders. These measures provide the necessary resources and information to facilitate effective adaptation.

#### **Key Components:**

- Offering subsidies and tax breaks for climate-resilient practices.
- Providing climate information services that offer real-time data and forecasts.

#### **Examples of Best Practices:**

- The use of climate information services helps stakeholders make informed decisions based on weather forecasts.
- Financial incentives for green building practices encourage sustainable construction and retrofitting.

### **5.3. Proposed Indicators for Climate Change Adaptation Tailored for the Tourism Sector**

To effectively guide climate change adaptation and mitigation efforts in coastal tourism, policymakers need to prioritize a specific set of indicators at both the destination and regional levels. These indicators are crucial for ensuring tourism activities' sustainability and resilience against climate change's impacts. The proposed indicators are structured into five key categories: ***physical and environmental, economic, sociocultural, governance and policy, and biodiversity and ecosystem health indicators.***

At the ***destination level***, it is essential to monitor indicators such as changes in annual temperature, the number and frequency of hot days, sea-level rise, tourism revenue variability, tourist satisfaction, local community attitudes, and public awareness campaigns on water efficiency. These indicators provide a comprehensive overview of the local environmental, economic, and socio-cultural conditions. This facilitates targeted adaptation strategies that address both immediate and long-term vulnerabilities. At the ***regional level***, policymakers should emphasize indicators that reflect broader climate trends and regional coordination efforts. Key indicators include sea-level rise, tourism revenue variability, the cost of climate adaptation, the existence and implementation of climate adaptation policies, funding allocated for adaptation projects, and stakeholder involvement. These indicators are vital for regional planning, ensuring cohesive and scalable strategies that address the systemic drivers of climate change and enhance overall resilience.

In addition to these mandatory indicators, policymakers should consider a set of optional indicators to provide further insights and support more nuanced adaptation and mitigation efforts. At the destination level, optional indicators such as extreme precipitation days, the fire weather index, air quality, and marine submersion events and storm surges can offer additional information on specific climate risks and environmental conditions. Similarly, at the regional level, optional indicators like changes in annual temperature, the number and frequency of hot days, air quality, species



distribution changes, and water quality can enhance understanding of regional climate impacts and inform broader environmental health strategies. By distinguishing between mandatory and optional indicators, policymakers can ensure that critical aspects of climate change adaptation and mitigation are prioritized while allowing flexibility to address context-specific challenges and opportunities. This balanced approach supports the development of robust, effective, and contextually relevant strategies that enhance the sustainability and resilience of Mediterranean coastal tourism.

## **1. Physical and Environmental Indicators**

### **● Ind 1.1 Change in Annual Temperature**

- **Definition:** This indicator measures deviations from the long-term average annual temperature. It provides insight into how the local climate is changing over time.
- **Rationale:** Temperature changes directly affect tourist comfort and seasonal arrivals, influencing tourism patterns and infrastructure needs. Understanding these changes helps destinations plan for climate adaptation and mitigate negative impacts on tourism.
- **Measurement:** Degree Celsius change per year from a long-term average baseline (30 years).

### **● Ind 1.2 Number and Frequency of Hot Days**

- **Definition:** Counts the number of days per year exceeding a critical temperature threshold (e.g., 35°C) and the frequency of consecutive hot days.
- **Rationale:** Indicates stress levels on tourists and tourism infrastructure during heatwaves, affecting health and activity participation. The frequency of consecutive hot days can further stress infrastructure, increase health risks and potential occurrence of dry periods (droughts) and reduce the availability of water needed for tourism activities and related economic sectors (e.g. agriculture)..
- **Measurement:**
  - Number of days per year with maximum temperatures above the threshold.
  - Frequency of consecutive hot days exceeding the threshold (e.g. the number of instances where there are more than 3 consecutive hot days).
  - Number of tropical nights per year where the temperature does not fall below 20°C.

### **● Ind 1.3 Sea-Level Rise**

- **Definition:** Monitors the long-term increase in sea levels.



- **Rationale:** Rising sea levels threaten coastal tourism infrastructure, beaches, and natural attractions, necessitating adaptation strategies. This increase can lead to more frequent and severe flooding, erosion, and loss of habitat, directly impacting tourism and local communities. Understanding and monitoring sea-level rise is essential for developing effective coastal management and protection plans to safeguard these valuable resources.
- **Measurement:** Millimeters per year, measured using tide gauges and satellite altimetry.
- **Ind 1.4 Extreme Precipitation Days**
  - **Definition:** Counts the number of days with significant rainfall above a certain threshold and considers the water infiltration capacity of the ground.
  - **Rationale:** Important for assessing flood risks, impacting outdoor tourism activities and infrastructure. The risk varies based on ground properties, infiltration index, slope and artificialization rates.
  - **Measurement:**
    - Number of days per year with precipitation exceeding a set threshold (e.g., 50 mm).
    - Assessment of ground properties including infiltration index, slope, and artificialization rates to evaluate the actual risk and potential for water infiltration.
    - Frequency of extreme precipitation events, including consecutive days with heavy rainfall.
- **Ind 1.4 Fire Weather Index**
  - **Definition:** A scale indicating the risk of fire based on weather conditions.
  - **Rationale:** Monitoring the Fire Weather Index (FWI) is crucial for ensuring the safety of both tourists and local populations in forested areas. High FWI values can indicate increased risk of wildfires, which can devastate natural landscapes, disrupt tourism activities, and endanger lives. Effective monitoring and response to FWI levels are essential for preserving natural attractions and maintaining the economic stability of tourism-dependent regions.
  - **Measurement:** Fire Weather Index (FWI)<sup>11</sup> values calculated daily.
- **Ind 1.5 Air Quality**
  - **Definition:** Measures the concentration of greenhouse gases (GHGs) and small particles (e.g., PM2.5, PM10) in the air.

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<sup>11</sup> European Environment Agency. (2024). Fire weather index - monthly mean, 1979-2020. European Climate Adaptation Platform Climate-ADAPT. Retrieved from <https://climate-adapt.eea.europa.eu/en/metadata/indicators/fire-weather-index-monthly-mean-1979-2019>



- **Rationale:** Air quality significantly impacts tourist health and comfort, as poor air quality can deter tourism activities. Monitoring air quality is essential for ensuring a safe and pleasant environment for visitors and residents alike. Additionally, air quality serves as a broader indicator of environmental health and sustainability, reflecting the overall effectiveness of pollution control measures and environmental policies.
- **Measurement:** Concentration of GHGs (measured in parts per million) and small particles (measured in micrograms per cubic meter) using air quality monitoring stations.
- **Ind. 1.6 Marine Submersion Events and Storm Surges**
  - **Definition:** Measures the frequency and impact of marine submersion events or storm surges on coastal areas.
  - **Rationale:** Marine submersion events and storm surges pose significant risks to coastal tourism infrastructure and safety, impacting beaches, resorts, and other coastal attractions. These events can lead to severe flooding, erosion, and property damage, disrupting tourism activities and endangering lives. Monitoring these events is crucial for developing effective coastal management strategies and emergency response plans, ensuring the resilience and sustainability of coastal tourism destinations.
  - **Measurement:**
    - Number of marine submersion events or storm surges per year.
    - Extent of the impacted area measured in square kilometers.
    - Economic damage measured in local currency.
- **Ind. 1.7 Water availability per inhabitant**
  - **Definition:** This indicator measures the average amount of available water per person in a specific region over a given period. It reflects the balance between water supply and demand, indicating the sufficiency of water resources to meet the needs of the population.
  - **Rationale:** Water availability is critical for both residents and tourists, influencing the sustainability of tourism activities, overall health, and quality of life. Understanding water availability helps in planning and managing water resources efficiently, ensuring that tourism growth does not compromise local water needs.
  - **Measurement:** Cubic meters of water available per inhabitant annually.





## 2. Economic Indicators

### ● Ind 2.1 Tourism Revenue Variability

- **Definition:** Measures changes in tourism revenue over time.
- **Rationale:** Tourism revenue variability indicates the economic impact of climate variability on tourism revenue, reflecting the sector's resilience. Understanding this variability is essential for assessing how climate events and seasonal changes affect tourism income, which in turn helps in planning for economic stability and growth. By tracking revenue fluctuations, stakeholders can identify patterns and develop strategies to mitigate negative impacts and enhance the sector's adaptability to changing climate conditions.
- **Measurement:** Percentage change in tourism revenue annually, adjusted for inflation.

### ● Ind 2.2 Cost of Climate Adaptation

- **Definition:** Tracks investments required to adapt tourism infrastructure to climate change, including both capital and operational expenses.
- **Rationale:** Understanding the cost of climate adaptation is crucial for budgeting, planning, and ensuring sustainable tourism. Knowing the full financial requirements, including ongoing operational expenses, provides a comprehensive picture of the economic impact of climate adaptation efforts. This information helps stakeholders allocate resources effectively, prioritize investments, and develop strategies that enhance the resilience and sustainability of tourism infrastructure.
- **Measurement:**
  1. Monetary value (in local currency) of adaptation investments annually.
  2. Monetary value (in local currency) of operational expenses related to climate adaptation annually.

### ● Ind 2.3 Insurance Costs

- **Definition:** Measures changes in insurance premiums for tourism-related properties.
- **Rationale:** Insurance costs reflect the increased economic risks from climate impacts on tourism infrastructure. Rising premiums indicate higher perceived risks by insurers, driven by factors such as more frequent and severe weather events, which can cause significant damage to tourism facilities. Monitoring these changes helps stakeholders understand the financial implications of climate risks and aids in planning for resilience and risk management strategies.
- **Measurement:** Percentage change in insurance premiums annually.



### 3. Sociocultural Indicators

- **Ind 3.1 Tourist Satisfaction**

- **Definition:** Assesses satisfaction levels of tourists regarding their experiences.
- **Rationale:** Tourist satisfaction is influenced by climate conditions and their impact on the overall tourist experience. High satisfaction levels are essential for positive reviews, repeat visits, and sustained tourism revenue. Understanding satisfaction trends helps tourism managers make informed decisions to enhance the quality of services and address issues related to climate impacts, ensuring a positive and resilient tourism environment.
- **Measurement:** Average satisfaction rating from tourist surveys on a scale of 1 to 10.

- **Ind 3.2 Local Community Attitudes**

- **Definition:** Surveys local perceptions of tourism and climate change.
- **Rationale:** Understanding local community attitudes towards tourism and climate change adaptation is crucial for securing community support and ensuring sustainable tourism development. Positive community attitudes are essential for the successful implementation of tourism projects and climate adaptation strategies, as they foster cooperation, minimize conflicts, and enhance the social license to operate. Monitoring these attitudes helps identify areas of concern, allowing stakeholders to address issues proactively and build stronger, more resilient communities.
- **Measurement:** Percentage of positive responses in community surveys regarding tourism and climate change adaptation.

- **Ind 3.3 Public Awareness Campaigns on Water Efficiency**

- **Definition:** Number of campaigns aimed at promoting sustainable water use practices.
- **Rationale:** Public awareness campaigns on water efficiency encourage sustainable practices among tourists and businesses, helping to mitigate the impacts of water scarcity. These campaigns play a critical role in educating the public about the importance of conserving water resources, reducing water wastage, and adopting water-efficient technologies. By fostering a culture of sustainability, these initiatives contribute to the long-term resilience and sustainability of tourism destinations.
- **Measurement:** Number of campaigns conducted annually.



#### 4. Governance and Policy Indicators

- **Ind 4.1 Effectiveness of Climate Adaptation Policies**

- **Definition:** Existence and implementation of policies aimed at adapting tourism to climate change.
- **Rationale:** The effectiveness of climate adaptation policies reflects the quality of governance and preparedness for climate resilience in the tourism sector. Robust and well-implemented policies are crucial for mitigating the impacts of climate change, ensuring the sustainability and resilience of tourism destinations. These policies support infrastructure development, risk management, and community engagement, highlighting the commitment of local authorities to protect and enhance tourism under changing climatic conditions.
- **Measurement:** Qualitative assessment of policy presence (document existence) and implementation status (fully implemented, partially implemented, not implemented).

- **Ind 4.2 Funding for Adaptation Projects**

- **Definition:** Amount of funding allocated for climate adaptation in tourism.
- **Rationale:** Funding for climate adaptation projects is a key indicator of the prioritization and commitment by governments and stakeholders towards achieving climate resilience in the tourism sector. Adequate funding is essential for the development and implementation of effective adaptation measures, such as infrastructure improvements, risk assessments, and community education programs. Monitoring this funding helps to understand the readiness and capacity of the tourism sector to withstand and adapt to climate impacts.
- **Measurement:** Monetary value (in local currency) of allocated funds annually.

- **Ind 4.3 Stakeholder Involvement**

- **Definition:** Level of involvement of local stakeholders in climate adaptation planning.
- **Rationale:** Stakeholder involvement is crucial for developing inclusive and effective climate adaptation strategies. Engaging local stakeholders ensures that adaptation measures are tailored to the specific needs and priorities of the community, enhancing the legitimacy and acceptance of these measures. Involving a wide range of stakeholders, including local residents, businesses, and environmental organizations, fosters collaboration and leverages local knowledge, leading to more resilient and sustainable outcomes.



- **Measurement:** Number of stakeholder meetings and participation rates annually.

## 5. Biodiversity and Ecosystem Health Indicators

### ● Ind 5.1 Species Distribution Changes

- **Definition:** Tracks the movement of species due to climate shifts.
- **Rationale:** Monitoring species distribution changes is critical for eco-tourism and wildlife viewing experiences. Changes in species distribution can also indicate the presence of alien species, which can pose risks to both local ecosystems and tourists. Alien species may carry diseases or exhibit aggressive behavior, potentially endangering tourists and disrupting native wildlife habitats.
- **Measurement:** Number of species showing significant distribution changes annually.

### ● Ind 5.2 Habitat Loss and Degradation

- **Definition:** Measures the extent and quality of natural habitats.
- **Rationale:** Habitat loss and degradation significantly impact natural attractions and biodiversity-based tourism. The health and extent of natural habitats are crucial for maintaining the biodiversity that supports tourism activities such as wildlife viewing, hiking, and nature photography. Loss and degradation of these habitats not only diminish the aesthetic and recreational value of tourism destinations but also threaten the ecosystems that sustain local communities and wildlife. Understanding and monitoring these changes are essential for conservation efforts and sustainable tourism development.
- **Measurement:** Area (hectares) of habitat lost or degraded annually (frequency of the assessment should be adjusted to the site specific conditions).

### ● Ind 5.3 Water Quality

- **Definition:** Levels of pollutants in water bodies used for tourism activities.
- **Rationale:** Water quality is crucial for water-based tourism activities and overall environmental health. High levels of pollutants can deter tourists, pose health risks, and damage aquatic ecosystems, which are essential for maintaining the appeal and sustainability of tourism destinations. Ensuring good water quality supports safe and enjoyable recreational activities such as swimming, diving, and boating, while also protecting biodiversity and ecosystem services.



- **Measurement:** Concentration of key pollutants (e.g., nitrates, phosphates) in water samples taken quarterly.
  1. Chemical pollutants: concentration of key chemical pollutants (e.g., nitrates, phosphates) in water samples.
  2. Microorganisms: concentration of microorganisms, including bacteria (e.g., E. coli) and viruses, in water samples.
  3. Sampling frequency: water samples taken quarterly from multiple locations within the tourism area.
- **Ind 5.4 Protected Areas**
  - **Definition:** Extent and condition of protected natural areas.
  - **Rationale:** Protected areas are crucial for nature-based tourism and conservation efforts. They help preserve biodiversity, support ecosystem services, and provide recreational and educational opportunities. The "condition" of these areas refers to their ecological health and the effectiveness of management practices in achieving conservation goals. This includes maintaining species diversity, preventing habitat degradation, and ensuring sustainable use of natural resources. Effective management of protected areas enhances their value for tourism and conservation.
  - **Measurement:**
    1. Area (hectares) under protection and assessment of ecological condition annually.
    2. Evaluation of the effectiveness of management practices in achieving conservation targets using tools such as the Management Effectiveness Tracking Tool (METT) or other similar frameworks.



## 6. RECOMMENDATIONS FOR IMPLEMENTATION OF CRITERIA AND INDICATORS

Assessing climate change impacts and developing effective strategies is a complex, sequential process that involves three key steps: (1) conducting a comprehensive climate change impact assessment, (2) understanding and characterizing the associated risks, and (3) developing robust risk management strategies. **While the first two steps are integral parts of the established process and are carried out by a team of experts, the following sections focus on the integration and selection of criteria and indicators specifically designed for the pilot destinations and regions within this project.** This includes a detailed explanation of the process for selecting both indicators and criteria at both the destination and regional levels, ensuring that the methodologies are tailored to address the unique challenges and opportunities presented by each location.

### 6.1 Recommendations for Implementing Climate Change Adaptation and Mitigation Criteria in Coastal Tourism

To effectively implement climate change adaptation and mitigation **criteria** in coastal tourism, policymakers should adopt a strategic and phased approach. This involves establishing foundations, integrating criteria into policies and practices, and ensuring continuous monitoring and refinement.

#### ***Establishing Foundations:***

Policymakers should begin by engaging a broad range of stakeholders, including local communities, tourism operators, governments, and NGOs. This engagement ensures that the criteria reflect diverse needs and perspectives, fostering a sense of ownership and commitment among stakeholders. Building capacity through comprehensive training programs is essential. These programs should enhance local capacities and bridge knowledge gaps related to climate adaptation and mitigation. By equipping stakeholders with the necessary skills and knowledge, we can ensure they are well-prepared to implement and sustain the proposed measures. Additionally, securing funding is crucial. Policymakers should explore and secure diverse funding sources, such as public-private partnerships, international aid, and climate finance mechanisms, to support the implementation of the proposed measures. Adequate funding ensures that resources are available to carry out the necessary actions, from infrastructure development to community programs and beyond.

#### ***Integrating and Executing Criteria:***

In the next phase, the focus shifts to integrating the criteria into local and regional policies and executing practical measures. Policymakers should advocate for incorporating climate adaptation and mitigation considerations into planning and development policies to ensure these aspects are systematically addressed. Promoting the construction of resilient and flexible infrastructure that can adapt to changing



environmental conditions is vital for long-term sustainability. Furthermore, launching targeted awareness campaigns and inclusive engagement strategies helps to foster community buy-in and active participation in climate action. By making the criteria part of the standard operating procedures, we ensure that climate considerations become an integral part of tourism planning and development.

### ***Monitoring and Refining Strategies:***

The final phase emphasizes the importance of monitoring and continuous improvement. Developing robust monitoring and evaluation frameworks with clear indicators is necessary to track the effectiveness of implemented measures. Policymakers should leverage advanced technologies such as remote sensing, GIS, and climate modeling to enhance data collection and analysis. These technologies provide accurate and timely information on environmental changes, infrastructure resilience, and community engagement, enabling a more comprehensive understanding of the impacts and effectiveness of the adaptation and mitigation strategies. Regular reporting mechanisms are essential for maintaining transparency and accountability. By implementing consistent reporting schedules, progress can be tracked, and findings shared with stakeholders, fostering a culture of openness and continuous improvement. Creating feedback loops ensures that lessons learned and stakeholder inputs are systematically incorporated into the ongoing refinement and adjustment of strategies. This iterative process allows for the dynamic adaptation of measures, ensuring they remain effective and relevant in the face of evolving climate conditions and emerging challenges.

## **6.2 Recommendations for Implementing Indicators for Climate Change Adaptation and Mitigation in Coastal Tourism**

To effectively implement **indicators** for climate change adaptation and mitigation in coastal tourism, policymakers need to establish a robust framework that ensures data quality, stakeholder engagement, and continuous improvement. Here are the key recommendations for achieving this:

### ***Engage Diverse Data Sources:***

To implement physical and environmental indicators, such as changes in annual temperature, number and frequency of hot days, and sea-level rise, policymakers should rely on data from meteorological agencies, satellite observations, and climate monitoring networks. Organizations like the European Space Agency (ESA) and national meteorological services provide crucial climate data through remote sensing and ground-based observations. For economic indicators, including tourism revenue variability and the cost of climate adaptation, data should be sourced from tourism boards, financial records from local businesses, and governmental economic reports. Sociocultural indicators, such as tourist satisfaction and local community attitudes, can be gathered through structured surveys, interviews, and public opinion polls conducted by research institutions and local tourism authorities. Governance and policy indicators, like climate adaptation policies and funding for adaptation projects, require data from policy documents, government reports, and funding allocation records. Biodiversity and



ecosystem health indicators, such as species distribution changes and water quality, benefit from data collected by environmental agencies, conservation organizations, and academic research institutions. Ensuring the integration of these diverse data sources will enhance the robustness and comprehensiveness of the monitoring framework.

***Ensure Data Quality and Availability:***

Maintaining high data quality is crucial. Data should be collected from reliable and consistent sources, employing standardized methodologies to maintain accuracy and comparability across all indicators. Policymakers must address potential data gaps, inconsistencies, and variability in data collection practices, particularly in regions with limited monitoring infrastructure.

***Utilize Advanced Technologies:***

Leverage advanced technologies such as remote sensing, IoT devices, and automated data collection tools. These technologies facilitate real-time monitoring of climate variables and environmental conditions, providing high-resolution spatial and temporal data. This approach enables a comprehensive understanding of climate impacts on tourism and supports timely decision-making.

***Tailor Indicators to Specific Contexts:***

Indicators should be tailored to the specific context of each tourism destination, considering local environmental, economic, and sociocultural factors. Generic indicators may not fully capture the unique challenges and opportunities of individual destinations, reducing the relevance and applicability of the data.

***Foster Continuous Stakeholder Engagement:***

Continuous engagement with a broad range of stakeholders, including local communities, tourism operators, and policymakers, is essential. This engagement ensures that indicators are relevant and actionable. Lack of stakeholder buy-in can result in poor implementation and limited practical use of the indicators.

***Address Technological and Resource Constraints:***

Ensure stakeholders have the necessary resources and training to utilize advanced technologies. Technological and resource limitations can hinder the comprehensive implementation and monitoring of indicators, especially in resource-constrained regions.

***Consider Both Average Conditions and Extreme Events:***

Indicators should reflect both average conditions and extreme events to provide a holistic view of climate impacts. Using scenario modeling to predict future impacts can help in understanding the potential risks and opportunities under various conditions.



***Align with Existing Frameworks:***

Integrate new indicators with existing monitoring and evaluation systems to leverage current data and resources. Misalignment can lead to redundancy, inefficiency, and confusion among stakeholders.

***Regular Reviews and Updates:***

Conduct periodic reviews and updates of the indicators to reflect new scientific insights, evolving climate conditions, and stakeholder feedback. Stagnant indicators may fail to capture the dynamic nature of climate impacts and adaptive responses, reducing their effectiveness over time.

***Comply with Legal and Regulatory Frameworks:***

Ensure that indicator implementation complies with local, national, and international legal and regulatory frameworks. Stay informed about regulatory changes that could impact the feasibility and applicability of certain indicators.

***Recognize Interdependencies:***

Understand the interdependencies between different indicators and consider the broader socio-economic and environmental context when analyzing results. Focusing on individual indicators in isolation can lead to fragmented understanding and suboptimal adaptation strategies.

***Outcome and Recommendations:***

Implementing a systematic approach to data collection for each indicator involves establishing standardized protocols, leveraging advanced technologies, and engaging local stakeholders. Regular trend analyses and scenario modeling help in understanding the evolving nature of climate risks. Producing regular reports in multiple formats ensures transparency and accessibility, while establishing feedback mechanisms helps in refining indicators and improving data collection processes.



## 7. CONCLUSION

The development and implementation of robust climate change adaptation and mitigation criteria for coastal tourism in the Mediterranean region are essential for ensuring the sustainability and resilience of this vital sector. This deliverable has outlined a comprehensive framework for both regional and destination levels, providing actionable guidelines to address the unique challenges posed by climate change.

By integrating these criteria into strategic planning, regions and destinations can systematically evaluate their efforts, identify gaps, and implement targeted actions to enhance their climate resilience. This process involves aligning tourism goals with adaptation and mitigation criteria, revising policies to support sustainable practices, engaging stakeholders in meaningful ways, and continuously monitoring and evaluating progress.

The indicators selected for this framework serve as critical tools for measuring the effectiveness of these efforts. They provide concrete data to inform decision-making, ensuring that strategies are based on reliable and timely information. By using advanced technologies and maintaining high data quality, stakeholders can gain a comprehensive understanding of climate impacts and make informed adjustments to their strategies.

Continuous stakeholder engagement is crucial for the successful implementation of both criteria and indicators. By involving local communities, tourism operators, policymakers, and other relevant parties, the adaptation and mitigation measures can be tailored to the specific needs and contexts of each region and destination. This inclusive approach not only fosters ownership and commitment but also ensures that the measures are practical and effective.



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## **ANNEXES.**

### ***ANNEX 1. Criteria Development for Climate Change Adaptation Assessment in Coastal Tourism Destinations.***

### ***ANNEX 2. Indicator Proposal for Climate Change Adaptation.***





# Criteria Development for Climate Change Adaptation Assessment in Coastal Tourism Destinations

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## Executive Summary

### Purpose and Objectives

The purpose of this report is to develop a comprehensive set of criteria for assessing climate change adaptation and mitigation in coastal tourism destinations within the Mediterranean region. These criteria aim to support decision-makers and local communities by providing actionable information and best practices that enhance the resilience of tourism destinations to climate change impacts. The main objectives include establishing criteria covering key dimensions such as environmental sustainability, economic viability, socio-cultural integrity, governance, and resilience building, facilitating targeted assessments, and promoting sustainable tourism practices.

### Key Findings

Stakeholder engagement and needs assessment revealed significant challenges and opportunities in addressing climate change adaptation and mitigation in coastal tourism. Key findings include:

- **Environmental Changes:** Increased temperatures, altered precipitation patterns, extreme weather events, rising sea levels, and coastal erosion threaten tourism activities, infrastructure, and natural attractions.
- **Infrastructure and Biodiversity:** Marine biodiversity degradation and threats to tourism infrastructure from ocean acidification and storm surges are major concerns.
- **Economic Implications:** The tourism sector's contribution to greenhouse gas emissions exacerbates climate change, leading to increased operational costs and economic risks.
- **Challenges in Adapting to Climate Change:** Financial constraints, insufficient data, limited stakeholder engagement, and inadequate policy frameworks were identified as primary barriers.
- **Opportunities for Enhancing Climate Resilience:** Promoting eco-tourism, adopting renewable energy, implementing nature-based solutions, and engaging local communities are key opportunities for enhancing resilience.

The criteria development process involved a critical review of existing frameworks, guidelines, and case studies, which informed the creation of draft criteria. These criteria were validated and refined through further stakeholder engagement, ensuring they are practical, comprehensive, and tailored to address specific adaptation challenges and opportunities.

### Recommendations

#### For Climate Change Adaptation at the Destination Level:

- **Environmental Sustainability:** Prioritize monitoring and managing natural evolution, implementing flexible and reversible measures, and promoting soft engineering solutions to stabilize coastal ecosystems.
- **Economic Viability:** Focus on cost-effective adaptation measures and ensure tourism revenue resilience through climate-resilient infrastructure and rapid recovery plans.
- **Socio-Cultural Integrity:** Engage local communities in adaptation planning, enhance public education and awareness, and integrate community knowledge into adaptation strategies.

- **Governance and Policy Support:** Incorporate climate change considerations into tourism development and spatial planning, enhance crisis preparation and management, and develop supportive policies and regulations.
- **Resilience Building:** Promote removable and flexible infrastructure and implement complementary measures such as financial incentives and climate services.

**For Climate Change Mitigation at the Destination and Regional Levels:**

- **Greenhouse Gas Reduction:** Encourage renewable energy adoption and energy efficiency measures across tourism operations.
- **Sustainable Practices:** Implement sustainable agriculture and food systems, and improve waste and water management practices to reduce emissions.
- **Transportation:** Promote public transport, electric vehicles, and non-motorized transport options to reduce tourism-related emissions.
- **Policy and Legislation:** Develop and enforce climate policies and economic instruments to incentivize sustainable practices and emission reductions.
- **Community Engagement and Education:** Foster stakeholder collaboration and conduct public awareness campaigns to support and implement mitigation strategies.

By implementing these recommendations, coastal tourism destinations in the Mediterranean can enhance their resilience to climate change, safeguard natural and cultural resources, and support sustainable economic growth. The developed criteria serve as a model for other regions facing similar challenges, contributing to global efforts in combating climate change and promoting sustainable tourism practices.

# 1. Introduction

## 1.1 Context

The Mediterranean region is renowned for its rich biodiversity, cultural heritage, and scenic coastlines, making it a top global tourism destination. However, this popularity brings significant challenges, particularly as the region faces increasing vulnerability to the adverse effects of climate change. Coastal tourism, which heavily relies on stable and predictable weather patterns, is especially susceptible to these changes. Key climate-related challenges include rising sea levels, more frequent extreme weather events, coastal erosion, and biodiversity loss. These factors threaten the sustainability of Mediterranean coastal tourism, a critical component of the region's economy and environmental health.

Our previous analysis, as detailed in the "Literature Review and Desk Analysis" report, has highlighted several critical conclusions that lay the foundation for developing robust criteria for climate change adaptation and mitigation in coastal tourism:

- **Environmental Changes:** Increased temperatures, altered precipitation patterns, and extreme weather events disrupt traditional tourism activities and seasons, especially in winter and coastal destinations. Rising sea levels and coastal erosion pose significant threats to tourism infrastructure and natural attractions like beaches and coral reefs.
- **Infrastructure and Biodiversity:** The degradation of marine biodiversity and the threat to tourism infrastructure from impacts such as ocean acidification and increased storm surges are major concerns. These factors diminish the appeal of natural attractions, which are vital for tourism.
- **Economic Implications:** The tourism sector's significant contribution to greenhouse gas emissions exacerbates climate change, creating a feedback loop that increases operational costs and risks economic losses. The need to reduce emissions through sustainable practices and low-carbon technologies is evident.
- **Challenges in Adapting to Climate Change:** Financial constraints, insufficient data and predictive models, limited stakeholder engagement, and inadequate policy frameworks were identified as primary barriers to effective adaptation. Additionally, prioritizing short-term economic interests over long-term sustainability goals complicates the implementation of necessary measures.
- **Opportunities for Enhancing Climate Resilience:** Promoting eco-tourism, adopting renewable energy, implementing nature-based solutions, and enhancing infrastructure resilience were identified as key opportunities. The engagement of local communities and diversification of tourism offerings are crucial for mitigating climate impacts and enhancing resilience.

The specific vulnerability of Mediterranean countries to climate change (IPCC, 2022) further complicates the situation. Southern and eastern countries are generally more vulnerable than their northern counterparts. Nations such as Tunisia, Algeria, and Libya are below the water scarcity threshold set by the Food and Agriculture Organization, while others like Morocco are close to severe water stress levels. The timing, duration, and intensity of extreme climatic events remain uncertain, posing significant risks to sectors like agriculture and tourism.

Economically, Mediterranean countries are susceptible to climate change across most socioeconomic sectors (IPCC, 2022). In low-income countries, a 1°C rise in temperature could reduce GDP by 1.1 points. Middle East and North Africa (MENA) countries could face a 10-13% GDP loss with a global temperature increase of 4.8°C by 2100. Freshwater resources, vital for agriculture, are particularly vulnerable, with high exposure to water stress and salinization due to sea level rise.

The tourism sector, crucial for the region, faces significant risks. Coastal tourism, generating USD 300 billion annually, is vulnerable to climate change, especially in low-income countries. The potential economic losses due to reduced tourist appeal, infrastructure damage, and biodiversity loss underscore the urgency for effective adaptation and mitigation strategies.

Given these challenges, it is imperative to develop urgent and comprehensive strategies for adaptation and mitigation to enhance the resilience of coastal tourism destinations. By addressing identified challenges and leveraging opportunities, we can formulate effective criteria for targeted assessments and strategies. These criteria will guide the evaluation of current practices, identify areas for improvement, and support the development of robust, evidence-based climate action plans tailored to the unique needs of Mediterranean coastal tourism destinations.

## 1.2 Scope of Work

This consultancy aims to support the development of a survey of available best practices on climate action in coastal tourism destinations. The primary objective is to create a unified and adaptable set of criteria for assessing climate change (CC) adaptation and mitigation issues in tourism, applicable at both Regional and Destination levels. Specifically, criteria for adaptation will be considered only for the destination (local) level, while criteria for mitigation will be considered for both regional and destination levels. These criteria are designed to facilitate targeted assessments, guiding strategies that are both impactful and feasible within the varied contexts of the Mediterranean region's coastal tourism destinations.

The scope of work includes:

1. Conducting a needs assessment and gap analysis to gather insights on current challenges, opportunities, and gaps in addressing climate change adaptation in tourism.
2. Reviewing existing frameworks and best practices to integrate proven practices into the criteria.
3. Developing draft criteria for climate change adaptation and mitigation.
4. Validating and refining the draft criteria through stakeholder engagement.

## 1.3 Objectives

The main objectives of this report are:

1. **Develop Comprehensive Criteria:** To establish a comprehensive, adaptable set of criteria for assessing climate change adaptation and mitigation in coastal tourism. These criteria will cover key dimensions such as environmental sustainability, economic viability, socio-cultural integrity, governance, and resilience building.
2. **Facilitate Targeted Assessments:** To enable targeted assessments that guide effective mitigation and adaptation strategies tailored to the unique needs of Mediterranean coastal tourism destinations.
3. **Support Decision-Makers:** To provide decision-makers and local communities with actionable information and best practices that enhance the resilience of tourism destinations to climate change impacts.
4. **Promote Sustainable Development:** To encourage the adoption of sustainable tourism practices that balance environmental protection with economic and social development in the Mediterranean region.

By achieving these objectives, the report aims to support the development and implementation of robust climate action plans, contributing to the long-term sustainability and resilience of coastal tourism destinations in the Mediterranean.

## 2. Methodology

The methodology for developing the criteria for assessing climate change adaptation and mitigation in coastal tourism destinations in the Mediterranean involved a multi-step approach. This included stakeholder identification and engagement, needs assessment and gap analysis, review of existing frameworks and best practices, development of draft criteria, and stakeholder validation and refinement. Each step was carefully designed to ensure the criteria were comprehensive, practical, and grounded in real-world insights and experiences.

### 2.1 Stakeholder Identification and Engagement

To ensure the criteria reflected diverse perspectives and needs, we identified and engaged a broad range of stakeholders involved in tourism and climate change adaptation. Stakeholder engagement was conducted through two primary methods:

1. **Stakeholder Survey:** A structured questionnaire was distributed to participants of the meeting in Zagreb (June 2024). This meeting included key stakeholders from pilot regions and other relevant experts.
2. **Online Surveys:** External experts in the field were identified and contacted to participate in the survey online. Participation was voluntary and followed informed consent protocols to ensure ethical standards were met.

### 2.2 Needs Assessment and Gap Analysis

The needs assessment and gap analysis aimed to gather insights on the current challenges, opportunities, and gaps in addressing climate change adaptation in tourism. The process involved the following steps:

1. **Data Collection:** Information was collected via structured questionnaires distributed during the Zagreb meeting and online surveys to external experts.
2. **Content Analysis:** Responses from the questionnaires were analyzed using content analysis techniques to identify common themes, challenges, opportunities, and gaps. This qualitative analysis provided a comprehensive understanding of the current state of climate change adaptation in coastal tourism.

### 2.3 Review of Existing Frameworks and Best Practices

A critical review of existing adaptation frameworks, guidelines, and case studies was conducted to inform the criteria development. This step involved:

1. **Identification of Relevant Documents:** Key documents, including international guidelines, regional frameworks, and successful case studies from within and outside the Mediterranean region, were identified.
2. **Critical Content Analysis:** The identified documents were subjected to critical content analysis to extract proven practices and insights. This analysis focused on understanding the effectiveness, transferability, and replicability of various adaptation and mitigation strategies.

### 2.4 Development of Draft Criteria

The development of draft criteria involved synthesizing insights from multiple sources:

1. **Synthesizing Insights:** Conclusions drawn from the needs assessment and gap analysis, expert opinions, and the critical content analysis of existing frameworks and best practices were combined.



2. **Formulation of Draft Criteria:** These combined insights were used to formulate an initial set of draft criteria covering key dimensions of climate change adaptation and mitigation in coastal tourism, including environmental sustainability, economic viability, socio-cultural integrity, governance, and resilience building.

## 2.5 Stakeholder Validation and Refinement

The draft criteria were then validated and refined through further stakeholder engagement:

1. **Review by Experts:** The draft criteria were shared with experts involved in the project, including representatives from pilot regions and other relevant stakeholders.
2. **Feedback and Refinement:** Feedback was solicited from these experts to ensure the criteria were practical, comprehensive, and tailored to address specific adaptation challenges and opportunities. This iterative process involved several rounds of feedback and refinement to finalize the criteria.

By following this structured and inclusive methodology, we ensured that the developed criteria were robust, evidence-based, and aligned with the needs and realities of Mediterranean coastal tourism destinations facing the impacts of climate change.

### 3. Review of Existing Frameworks and Best Practices

To inform the development of criteria for climate change adaptation and mitigation in coastal tourism, we analysed existing adaptation and mitigation frameworks, guidelines, and successful case studies from within and outside the Mediterranean region. The purpose of this analysis is to leverage existing knowledge and integrate proven practices into the criteria, ensuring they are grounded in practical, actionable insights. By understanding and applying these established methods, we can create robust criteria that support effective adaptation and mitigation strategies in coastal tourism.

This section of the document begins with a reflection on the results of the IPCC Sixth Assessment Report (2022) for the Mediterranean basin, followed by key insights from twelve selected initiatives, including frameworks, guidelines, projects, and case studies. It then presents a synthesis of the analysis, highlighting key insights on climate change adaptation and mitigation practices for the coastal Mediterranean. Finally, it reflects on the application of these insights to the development of criteria for climate change adaptation and mitigation in coastal tourism.

#### 3.1 The Mediterranean Basin: A Climate Change Hotspot: A reflection on the IPCC Sixth Assessment Report<sup>1</sup>

The Mediterranean Basin is widely recognized as a climate change hotspot, characterized by its high vulnerability and exposure to the impacts of climate change. Projections for the region consistently indicate rising temperatures, decreased rainfall, and continued sea level rise in the coming decades. These changes are expected to exacerbate the already dry summer conditions, leading to even hotter and drier environments and increasing instances of coastal flooding. These factors will not only directly affect human populations but also significantly harm terrestrial and marine ecosystems.

Climate models project that the Mediterranean Basin will experience regional warming rates approximately 20% higher than global averages, with a significant reduction in rainfall (approximately 12% less for a global temperature increase of 3°C). Although the Mediterranean may not see the highest warming rates globally, its unique combination of high exposure and vulnerability makes it particularly susceptible to climate change impacts. Rising temperatures will increase evaporation from water bodies and soils, leading to reduced water resources, drier soils, diminished river flows, and prolonged droughts. These changes will have profound effects on plants, animals, human health, and societal and economic structures.

Increasing temperatures and more intense heat waves pose substantial threats to human well-being, economic activities, and ecosystems in the Mediterranean. Despite the overall decline in rainfall, extreme weather events are expected to become more frequent and intense, increasing the risk of flash floods and their associated damage to infrastructure and communities. Warming and ocean acidification, driven by higher atmospheric carbon dioxide levels, will further impact marine ecosystems. Additionally, accelerating sea level rise threatens coastal ecosystems, historical sites, and the region's growing population.

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<sup>1</sup> <https://www.ipcc.ch/report/ar6/wg2/chapter/ccp4/#CCP4.4>

IPCC, 2022: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp., doi:10.1017/9781009325844.

### 3.1.1 Key Risks and Challenges

The Mediterranean faces numerous risks associated with projected climate change, which are heightened by several factors:

- A rapidly growing urban population vulnerable to heat waves with limited access to cooling solutions.
- Increasing numbers of people living in areas susceptible to sea level rise.
- Worsening water shortages, already affecting 180 million people.
- Rising agricultural water demands for irrigation.
- Economic reliance on tourism, which is threatened by extreme heat and international emission reduction policies affecting travel.
- The loss of ecosystems in oceans, wetlands, rivers, and uplands, many of which are already endangered by unsustainable practices.

Sea level rise in the Mediterranean is projected to be similar to global averages, potentially reaching 1.1 meters by the end of the century under a 3°C warming scenario. This rise will intensify coastal flooding, erosion, and salinization, impacting agriculture, fisheries, aquaculture, urban development, port operations, tourism, and cultural sites. Coastal adaptation measures, such as engineering protections and ecosystem-based solutions, are already being implemented, but these may not suffice as sea level rise accelerates.

Figure 1 Key risks across the Mediterranean region by 2100. The symbols above the map highlight risks enhanced by climate change which apply to the entire region with high confidence. Other risks are localised in the map.<sup>2</sup>



<sup>2</sup> Figure CCP4 FAQ4.1.1 in Ali, E., W. Cramer, J. Carnicer, E. Georgopoulou, N.J.M. Hilmi, G. Le Cozannet, and P. Lionello, 2022: Cross-Chapter Paper 4: Mediterranean Region. In: Climate Change 2022: Impacts, Adaptation and

### 3.1.2 Urgency for Efficient Adaptation and Mitigation Measures

Adapting to and mitigating the impacts of climate change in the Mediterranean requires substantial investment in coastal protection, sustainable development policies, and innovative solutions. Engineering options like dykes and groynes, while effective in the short term, may not sustain the recreational and ecological value of Mediterranean coasts. Nature-based solutions, such as restoring dunes and wetlands, offer immediate benefits but have limitations, especially in urbanized areas. Large-scale geoengineering projects, though proposed, carry unknown risks.

Given the high stakes, it is crucial for Mediterranean countries to implement efficient adaptation and mitigation measures to address the urgent challenges posed by climate change. Proactive efforts in reducing greenhouse gas emissions, protecting and restoring ecosystems, and investing in resilient infrastructure will be essential to safeguard the region's future.

### 3.1.3 Climate Change Adaptation in the Mediterranean Region: Strategies and Challenges

#### *Ocean and Coastal Systems*

Adapting to the impacts of climate change on marine ecosystems and fisheries in the Mediterranean requires a multifaceted approach. Key strategies include expanding and enhancing the network of marine protected areas, fostering transnational management of marine resources, adopting sustainable fishing practices, and developing collaborative platforms for monitoring, research, and knowledge sharing. Sustainable aquaculture practices are also essential in this regard.

To address sea level rise, the Mediterranean can implement nature-based solutions such as beach and shore nourishment, dune restoration, and ecosystem-based adaptation in low-lying coastal areas, lagoons, estuaries, and deltas. Engineering solutions also play a critical role, including the construction of breakwaters, seawalls, dykes, surge barriers, and submerged breakwaters. However, these engineering measures can have significant residual impacts on coastal ecosystems. A proposed sea surface height control dam at the Strait of Gibraltar could mitigate sea level rise but may have substantial ecological and fisheries-related consequences.

#### *Inland Ecosystems*

In Mediterranean forests, adaptation strategies to cope with warming and drought include diverse forest management practices such as thinning, increasing the proportion of drought-tolerant species, and promoting mixed-species stands. To mitigate increased fire risks, improved residential planning to avoid wildfires, enhanced fire suppression capacities, strategic landscape management to reduce fire risks, thinning, slash management, prescribed burning, and understory grazing are crucial. Effective forest management also necessitates improved monitoring systems and participatory management processes.

For freshwater ecosystems, adaptation involves hydrological and land use planning at the basin scale, complemented by local conservation and restoration efforts. Preserving the natural flow variability of rivers and streams is vital for maintaining ecosystem health.

#### *Water Management, Agriculture, and Food Security*

Addressing water shortages in the Mediterranean requires transboundary resource management, equitable and sustainable water trade, and comprehensive water resource management plans at regional, national, and basin scales. Technical solutions include reducing water losses in distribution networks,

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Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 2233–2272, doi:10.1017/9781009325844.021.

desalination, artificial groundwater recharge, and wastewater reuse. On the demand side, strategies include changing dietary and water consumption patterns and enhancing water use efficiency in tourism and food sectors.

In agriculture, improving irrigation efficiency and adopting sustainable practices can save significant water resources. However, poorly managed irrigation subsidies can lead to unsustainable groundwater use and excessive agricultural intensification. Adaptation options for livestock include selecting more heat-resistant breeds, while agro-ecological techniques such as mulching and zero tillage can increase soil water retention. Crop diversification, adapting crop calendars, and using new varieties suited to changing conditions are also important.

#### *Human Health*

Adapting to the health impacts of climate change in the Mediterranean involves developing local urban health adaptation plans, enhancing healthcare system capacity, and implementing integrative urban strategies. These strategies should address housing and infrastructure, increase urban green spaces, raise awareness among vulnerable communities, establish early warning systems for extreme events, and strengthen local emergency and healthcare services.

#### *Limits to Adaptation, Equity, and Climate Justice*

The Mediterranean faces significant challenges in adapting to rapid sea level rise, particularly if Antarctic ice sheets collapse. While moderate sea level rise may be manageable with existing technologies, continued rise beyond 2100 may necessitate managed retreat in low-lying areas. Adaptation efforts are complicated by asymmetric demographic, environmental, and socioeconomic trends across the region, as well as a lack of effective regional governance schemes.

Vulnerability in the Mediterranean is closely linked to equity, with the elderly, women, and children being particularly at risk. Adaptation plans must consider the cost of adaptation and ensure fair solutions that address the socioeconomic and geopolitical variabilities and vulnerabilities specific to the region.

#### *Pathways for Sustainable Development*

Achieving climate-resilient sustainable development in the Mediterranean requires combining adaptation and mitigation efforts through iterative, evolving socioecological processes. Transformative adaptation can be promoted through social and political processes that facilitate structural changes. Key options include transitioning to renewable energy, producing renewable biological resources, improving water irrigation efficiency, promoting behavioral changes across sectors, and enhancing regional governance.

### 3.2 Key Insights from the selected initiatives (frameworks, guidelines, projects, case studies)

#### 3.2.1 Identification and Listing of Adaptation and Mitigation Measures: Assessment of selected climate change adaptation measures for coastal areas<sup>3</sup>

##### **Adaptation Measures**

##### **1. Natural Evolution Under Monitoring**

- **Surveillance/Observation Network:** Implementing monitoring tools to acquire knowledge about physical processes.

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<sup>3</sup> Baills, A., Garcin, M., & Bulteau, T. (2020). Assessment of selected climate change adaptation measures for coastal areas. *Ocean & Coastal Management*, 185, 105059. <https://doi.org/10.1016/j.ocecoaman.2019.105059>

- **Flexible/Reversible Measures:** Actions that can be easily reversed without significant financial impact.
- 2. **Accompaniment of Natural Processes**
  - **Dune Management:** Managing sand dunes by replanting vegetation or using ecological engineering methods to stabilize sand and control erosion.
  - **Marsh and Cliff Management:** Flexible management of marshes and cliffs to control erosion.
- 3. **Hazard Mitigation**
  - **Flood Runoff Control:** Measures to control runoff and mitigate flooding in strategic areas.
  - **Water Evacuation Systems:** Systems to prevent water from entering flood-prone areas or to evacuate water effectively.
- 4. **Soft Engineering**
  - **Beach Nourishment:** Adding sand to beaches to combat erosion and maintain beach profiles.
  - **Ecological Engineering:** Using natural materials and processes to stabilize beaches and dunes.
- 5. **Hard Engineering**
  - **Sea Walls and Breakwaters:** Constructing physical barriers to protect against coastal erosion and storm surges.
  - **Erosion Control Structures:** Installing structures to prevent or slow down coastal erosion.
- 6. **Reducing Vulnerability**
  - **Removable Buildings:** Constructing buildings that can be moved or dismantled in response to changing environmental conditions.
  - **Crisis Preparation:** Enhancing the resilience of communities through preparation and planning for potential disasters.
- 7. **Complementary Measures**
  - **Education and Awareness:** Programs to raise awareness and educate the public about coastal risks and adaptation strategies.
  - **Urban Planning:** Integrating climate change considerations into urban planning and development regulations.
  - **Financial Incentives:** Providing incentives such as subsidies and tax breaks to encourage adaptation efforts.
  - **Climate Services and Information:** Creating services to provide climate-related information to citizens and stakeholders.

## Mitigation Measures

1. **Greenhouse Gas Reduction**
  - **Renewable Energy Sources:** Promoting the use of renewable energy to reduce dependence on fossil fuels.
  - **Energy Efficiency:** Implementing measures to improve energy efficiency in buildings, transport, and industry.
  - **Carbon Sequestration:** Enhancing natural carbon sinks through reforestation and conservation of wetlands and other ecosystems.
2. **Sustainable Practices**
  - **Sustainable Agriculture:** Practices that reduce emissions from agricultural activities.
  - **Waste Management:** Improving waste management practices to reduce methane emissions from landfills.
3. **Transportation**

- **Public Transport Promotion:** Encouraging the use of public transport to reduce emissions from private vehicles.
  - **Electric Vehicles:** Promoting the adoption of electric vehicles to reduce emissions from transport.
4. **Policy and Legislation**
- **Climate Policies:** Developing and enforcing policies that limit emissions and promote sustainable practices.
  - **Economic Instruments:** Using tools such as carbon pricing, taxes, and subsidies to incentivize emission reductions.

## Analysis of Adaptation and Mitigation Measures

### Effectiveness

- **Adaptation Measures:** Measures such as beach nourishment and dune management are effective in the short to medium term but require regular maintenance and monitoring. Hard engineering solutions like sea walls provide immediate protection but can have long-term negative impacts on natural coastal processes. Flexible measures like removable buildings and ecological engineering are highly effective as they can adapt to changing conditions.
- **Mitigation Measures:** Renewable energy and energy efficiency measures are highly effective in reducing GHG emissions and have long-term benefits. Sustainable practices in agriculture and waste management contribute significantly to emission reductions but require widespread adoption and changes in behavior.

### Transferability

- **Adaptation Measures:** Many adaptation measures such as dune management and beach nourishment are transferable across different coastal contexts, including the Mediterranean, due to their reliance on natural processes. Hard engineering solutions may be less transferable due to varying coastal dynamics and environmental impacts.
- **Mitigation Measures:** Renewable energy technologies and energy efficiency measures are highly transferable as they can be implemented in various regions with appropriate technological and financial support. Policy measures and economic instruments are transferable but need to be tailored to local economic and regulatory contexts.

### Replicability

- **Adaptation Measures:** Ecological engineering and flexible management measures are easily replicable in different coastal areas as they rely on natural processes and local materials. Complementary measures like education, urban planning, and financial incentives are replicable but require strong institutional support and public engagement.
- **Mitigation Measures:** Practices such as renewable energy adoption and energy efficiency improvements are replicable with sufficient investment and infrastructure development. Sustainable agricultural practices and improved waste management systems are replicable but depend on local agricultural practices and waste management infrastructure.

## 3.2.2 Identification and Listing of Adaptation and Mitigation Measures: MPAs adapting to climate change: Results from the Interreg Med MPA-Adapt Project<sup>4</sup>

### Adaptation Measures

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<sup>4</sup> Otero, M., Iovinelli, A., Lázaro, L., & Suárez, S. (2019). MPAs adapting to climate change: Results from the Interreg Med MPA-Adapt Project. IUCN Centre for Mediterranean Cooperation. IUCN-Med received cofunding for this project from the MAVA Foundation. Retrieved from <file:///C:/Users/Ante/Downloads/Results-from-the-Interreg-Med-MPA-Adapt-Project.pdf>

1. **Research and Monitoring**
  - **Surveillance and Monitoring Programs:** Establish structured programs to track climate change impacts on marine biodiversity and socio-economic activities.
  - **Temperature Surveys and Fish Census:** Regular monitoring of sea surface temperatures and fish populations to assess climate-related changes.
  - **Mass Mortality Event Monitoring:** Specific protocols to document and analyze mass mortality events in benthic species.
2. **Protection and Conservation**
  - **Restoration Activities:** Initiate restoration projects for protected and rare species to enhance ecosystem resilience.
  - **Anchoring Regulations:** Enforce or strengthen regulations to prevent damage to critical habitats such as Posidonia meadows.
  - **Fire Risk Management:** Enhance fire surveillance and update fire management and evacuation plans.
3. **Community Engagement and Education**
  - **Citizen Science Programs:** Involve local communities and stakeholders in scientific monitoring and data collection.
  - **Educational Campaigns:** Develop educational programs and materials to raise awareness about climate change impacts and adaptation strategies.
4. **Governance and Policy**
  - **Adaptive Management Plans:** Develop and continuously update management plans to incorporate climate change adaptation measures.
  - **Stakeholder Collaboration:** Foster partnerships with local stakeholders, including fishers, tourists, and local authorities, to implement adaptive management practices.
5. **Technological Solutions**
  - **Renewable Energy Initiatives:** Pilot projects to reduce energy consumption and increase the use of renewable energy sources within MPAs.
  - **Water Management:** Optimize water consumption and ensure sustainable water availability for local communities.
6. **Specific Habitat Measures**
  - **Posidonia Habitat Monitoring:** Track the status and health of Posidonia meadows, including depth limits and flowering events.
  - **Coralligenous Habitat Monitoring:** Monitor the health and status of coralligenous communities and their responses to climate stressors.

## Mitigation Measures

1. **Sustainable Practices**
  - **Promotion of Non-Native Species:** Enhance the commercialization of non-native species to reduce pressure on native species.
  - **Ban on Disposable Plastics:** Implement bans or restrictions on the use of disposable plastics by fishers to reduce pollution and habitat degradation.
2. **Economic Instruments**
  - **Financial Incentives for Conservation:** Provide economic incentives to local communities and stakeholders to engage in conservation and sustainable practices.
  - **Support for Artisanal Fisheries:** Develop economic support mechanisms for artisanal fishers to adopt sustainable fishing practices.
3. **Policy and Legislation**



- **Integration of Climate Change in Policies:** Ensure that climate change adaptation and mitigation are integrated into local and national policies and management plans.
- **Adaptive Governance:** Develop adaptive governance frameworks that allow for flexible and responsive management strategies in the face of changing climate conditions.

## Analysis of Adaptation and Mitigation Measures

### Effectiveness

- **Adaptation Measures:**
  - **Research and Monitoring:** Effective in providing essential data to inform adaptive management and track changes over time. This enhances the resilience of marine ecosystems and local communities.
  - **Protection and Conservation:** Effective in preserving critical habitats and species, which can buffer against the impacts of climate change. Fire risk management and restoration activities directly contribute to ecosystem stability.
  - **Community Engagement:** Highly effective in building local capacity and support for adaptation measures. Citizen science programs and educational campaigns ensure long-term engagement and knowledge dissemination.
- **Mitigation Measures:**
  - **Sustainable Practices:** Effective in reducing the ecological footprint of local communities and promoting sustainable resource use. Bans on disposable plastics and promotion of non-native species help mitigate local environmental impacts.
  - **Economic Instruments:** Effective in incentivizing sustainable practices and providing financial support to vulnerable sectors, such as artisanal fisheries. This approach aligns economic interests with conservation goals.

### Transferability

- **Adaptation Measures:**
  - **Research and Monitoring:** Easily transferable to other coastal and marine environments. Standardized protocols and monitoring techniques can be adopted across different regions.
  - **Protection and Conservation:** Transferable with considerations for local ecological conditions. Habitat-specific measures, such as those for Posidonia meadows, can be adapted to similar ecosystems elsewhere.
  - **Community Engagement:** Transferable across different cultural and social contexts. Educational campaigns and citizen science programs can be tailored to local needs and knowledge systems.
- **Mitigation Measures:**
  - **Sustainable Practices:** Transferable with adjustments for local socio-economic conditions. Practices like banning disposable plastics and promoting sustainable fisheries can be implemented in various regions.
  - **Economic Instruments:** Transferable with policy and regulatory adjustments. Financial incentives and support mechanisms need to be aligned with local economic structures and priorities.

### Replicability

- **Adaptation Measures:**
  - **Research and Monitoring:** Highly replicable due to the standardized nature of protocols. Data collected can contribute to broader regional and global climate change databases.

- **Protection and Conservation:** Replicable with site-specific adaptations. Restoration and conservation measures can be replicated in similar habitats with appropriate local modifications.
- **Community Engagement:** Highly replicable as community-based approaches are universally applicable. Engaging local stakeholders in climate adaptation efforts can be modeled in other regions.
- **Mitigation Measures:**
  - **Sustainable Practices:** Replicable with community involvement and regulatory support. Encouraging sustainable practices and reducing plastic use are universally relevant strategies.
  - **Economic Instruments:** Replicable with tailored economic policies. Implementing financial incentives and support requires alignment with local economic conditions but can be modeled after successful examples.

**3.2.3 Identification and Listing of Adaptation and Mitigation Measures:** Baltadapt strategy for adaptation to climate change in the Baltic Sea Region: A proposal preparing the ground for political endorsement throughout the Baltic Sea Region<sup>5</sup>

**Adaptation Measures:**

1. **Research and Monitoring**
  - **Surveillance and Observation Networks:** Establishing networks to monitor climate impacts on marine biodiversity and socio-economic activities.
  - **Temperature Surveys and Fish Census:** Regular monitoring to track climate-related changes.
  - **Mass Mortality Event Monitoring:** Documenting and analyzing mass mortality events in benthic species.
2. **Protection and Conservation**
  - **Restoration Activities:** Initiating projects to restore protected and rare species.
  - **Anchoring Regulations:** Strengthening regulations to prevent damage to critical habitats like Posidonia meadows.
  - **Fire Risk Management:** Enhancing fire surveillance and updating fire management and evacuation plans.
3. **Community Engagement and Education**
  - **Citizen Science Programs:** Involving local communities and stakeholders in scientific monitoring and data collection.
  - **Educational Campaigns:** Developing programs and materials to raise awareness about climate change impacts and adaptation strategies.
4. **Governance and Policy**
  - **Adaptive Management Plans:** Developing and updating management plans to incorporate climate change adaptation measures.
  - **Stakeholder Collaboration:** Fostering partnerships with local stakeholders to implement adaptive management practices.

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<sup>5</sup> Andersson, L. (2013). Baltadapt strategy for adaptation to climate change in the Baltic Sea Region: A proposal preparing the ground for political endorsement throughout the Baltic Sea Region. Danish Meteorological Institute. Copenhagen. Retrieved from <https://www4.unfccc.int/sites/NAP/Documents%20NAP/Adaptation%20Strategies%20and%20Plans/Latvia%20Baltadapt%20Strategy%20for%20an%20Adaptation%20to%20Climate%20Change%20in%20the%20Baltic%20Sea%20Region.pdf>

## 5. Technological Solutions

- **Renewable Energy Initiatives:** Pilot projects to reduce energy consumption and increase renewable energy use within MPAs.
- **Water Management:** Optimizing water consumption and ensuring sustainable water availability.

## 6. Specific Habitat Measures

- **Posidonia Habitat Monitoring:** Tracking the status and health of Posidonia meadows, including depth limits and flowering events.
- **Coralligenous Habitat Monitoring:** Monitoring the health and status of coralligenous communities and their responses to climate stressors.

### Mitigation Measures:

#### 1. Sustainable Practices

- **Promotion of Non-Native Species:** Enhancing the commercialization of non-native species to reduce pressure on native species.
- **Ban on Disposable Plastics:** Implementing bans or restrictions on the use of disposable plastics by fishers.

#### 2. Economic Instruments

- **Financial Incentives for Conservation:** Providing economic incentives for local communities and stakeholders to engage in conservation and sustainable practices.
- **Support for Artisanal Fisheries:** Developing economic support mechanisms for artisanal fishers to adopt sustainable practices.

#### 3. Policy and Legislation

- **Integration of Climate Change in Policies:** Ensuring climate change adaptation and mitigation are integrated into local and national policies and management plans.
- **Adaptive Governance:** Developing frameworks that allow for flexible and responsive management strategies.

### Analysis of Adaptation and Mitigation Measures

#### Effectiveness

##### • Adaptation Measures:

- **Research and Monitoring:** Effective in providing essential data to inform adaptive management and track changes over time, enhancing ecosystem resilience.
- **Protection and Conservation:** Effective in preserving critical habitats and species, which buffer against climate change impacts. Fire risk management and restoration activities directly contribute to ecosystem stability.
- **Community Engagement:** Highly effective in building local capacity and support for adaptation measures. Citizen science programs and educational campaigns ensure long-term engagement and knowledge dissemination.

##### • Mitigation Measures:

- **Sustainable Practices:** Effective in reducing the ecological footprint of local communities and promoting sustainable resource use. Bans on disposable plastics and promotion of non-native species help mitigate local environmental impacts.
- **Economic Instruments:** Effective in incentivizing sustainable practices and providing financial support to vulnerable sectors, such as artisanal fisheries.

#### Transferability

##### • Adaptation Measures:

- **Research and Monitoring:** Easily transferable to other coastal and marine environments. Standardized protocols and monitoring techniques can be adopted across different regions.
- **Protection and Conservation:** Transferable with considerations for local ecological conditions. Habitat-specific measures can be adapted to similar ecosystems elsewhere.
- **Community Engagement:** Transferable across different cultural and social contexts. Educational campaigns and citizen science programs can be tailored to local needs and knowledge systems.
- **Mitigation Measures:**
  - **Sustainable Practices:** Transferable with adjustments for local socio-economic conditions. Practices like banning disposable plastics and promoting sustainable fisheries can be implemented in various regions.
  - **Economic Instruments:** Transferable with policy and regulatory adjustments. Financial incentives and support mechanisms need alignment with local economic structures and priorities.

### Replicability

- **Adaptation Measures:**
  - **Research and Monitoring:** Highly replicable due to standardized protocols. Data collected can contribute to broader regional and global climate change databases.
  - **Protection and Conservation:** Replicable with site-specific adaptations. Restoration and conservation measures can be replicated in similar habitats with appropriate local modifications.
  - **Community Engagement:** Highly replicable as community-based approaches are universally applicable. Engaging local stakeholders in climate adaptation efforts can be modeled in other regions.
- **Mitigation Measures:**
  - **Sustainable Practices:** Replicable with community involvement and regulatory support. Encouraging sustainable practices and reducing plastic use are universally relevant strategies.
  - **Economic Instruments:** Replicable with tailored economic policies. Implementing financial incentives and support requires alignment with local economic conditions but can be modeled after successful examples.

### 3.2.4 Identification and Listing of Adaptation and Mitigation Measures: Evaluation of climate change impacts and adaptation responses for marine activities “CLIMAR”<sup>6</sup>

#### Adaptation Measures:

##### 1. Structural Measures:

- **Artificial Islands:** Designed to reduce coastal erosion and provide flood protection.
- **Super Dikes:** Large dikes intended to significantly reduce flood risks.
- **Beach Nourishment:** Adding sand to beaches to combat erosion and maintain recreational areas.

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<sup>6</sup> Van den Eynde, D., De Sutter, R., De Smet, L., Francken, F., Haelters, J., Maes, F., Malfait, E., Ozer, J., Polet, H., Ponsar, S., Reynders, J., Van der Biest, K., Vanderperren, E., Verwaest, T., Volckaert, A., & Willekens, M. (2011). Evaluation of climate change impacts and adaptation responses for marine activities “CLIMAR”. Final Report. Belgian Science Policy Office. (Research Programme Science for a Sustainable Development). Retrieved from <https://climate-adapt.eea.europa.eu/en/metadata/publications/evaluation-of-climate-change-impacts-and-adaptation-responses-for-marine-activities-final-report>

- **Dike Heightening:** Increasing the height of existing dikes to improve flood defenses.
- 2. **Non-Structural Measures:**
  - **Managed Retreat:** Strategically relocating infrastructure and communities away from vulnerable coastal areas.
  - **Climate Proof Building Standards:** Implementing building codes that consider future climate impacts.
  - **Preparedness of Marinas:** Enhancing the resilience of marina infrastructure to withstand extreme weather events.
  - **Weather Forecasting Tools:** Providing accurate and timely weather information to assist in emergency planning and response.
  - **Road Pricing:** Implementing tolls to manage traffic and reduce congestion during evacuation scenarios.
- 3. **Ecological Engineering Measures:**
  - **Replanting Vegetation:** Stabilizing sand dunes to prevent erosion.
  - **Ecological Engineering for Beaches and Dunes:** Techniques to maintain and restore natural coastal defenses.
- 4. **Socio-Economic and Institutional Measures:**
  - **Surveillance/Observation Networks:** Monitoring natural evolution and hazards.
  - **Creation of Climate Services:** Providing information and education to the public about climate risks and adaptation measures.
  - **Communication via Media:** Raising awareness and disseminating information through various media channels.
- 5. **Fisheries Sector Specific Measures:**
  - **Changing Target Species:** Adapting to shifting fish populations by targeting new species.
  - **Flexible Fisheries Management:** Implementing adaptive management practices to respond to changing conditions.
  - **Ecosystem Management:** Incorporating broader ecological considerations into fisheries management.
- 6. **Tourism Sector Specific Measures:**
  - **All-Year-Round Accommodation:** Developing infrastructure to support tourism throughout the year, regardless of weather conditions.
  - **Innovative Insurance Premiums:** Offering insurance products tailored to mitigate climate risks for tourism businesses.
  - **Compensation for Bad Weather Days:** Financial mechanisms to compensate businesses for revenue loss due to adverse weather.

#### **Mitigation Measures:**

1. **Greenhouse Gas (GHG) Emission Reduction:**
  - **Renewable Energy Promotion:** Encouraging the use of renewable energy sources to reduce dependence on fossil fuels.
  - **Energy Efficiency Improvements:** Implementing measures to increase energy efficiency in buildings, transport, and industry.
  - **Carbon Sequestration:** Enhancing natural carbon sinks through reforestation and conservation of wetlands.
2. **Sustainable Practices:**
  - **Sustainable Agriculture:** Practices that reduce emissions from agricultural activities.
  - **Waste Management:** Improving waste management practices to reduce methane emissions from landfills.

3. **Transportation:**
  - **Public Transport Promotion:** Encouraging the use of public transport to reduce emissions from private vehicles.
  - **Electric Vehicles:** Promoting the adoption of electric vehicles to reduce emissions from transport.
4. **Policy and Legislation:**
  - **Climate Policies:** Developing and enforcing policies that limit emissions and promote sustainable practices.
  - **Economic Instruments:** Using tools such as carbon pricing, taxes, and subsidies to incentivize emission reductions.

## **Analysis of Adaptation and Mitigation Measures**

### **Effectiveness:**

- **Adaptation Measures:**
  - **Structural Measures:** Effective in reducing immediate flood risks and erosion. Super dikes and beach nourishment provide robust defenses against climate impacts.
  - **Non-Structural Measures:** Enhance community resilience and response capability. Measures like managed retreat and preparedness of marinas are crucial for long-term adaptation.
  - **Ecological Engineering:** Provide sustainable and long-term benefits by working with natural processes. Replanting vegetation and ecological engineering for beaches and dunes are effective in maintaining natural coastal defenses.
  - **Socio-Economic Measures:** Effective in building local capacity and awareness. Surveillance networks and climate services ensure informed decision-making and public engagement.
- **Mitigation Measures:**
  - **Renewable Energy and Energy Efficiency:** Highly effective in reducing GHG emissions and have long-term benefits. Promoting renewable energy and improving energy efficiency are key to sustainable mitigation.
  - **Sustainable Practices and Waste Management:** Contribute significantly to emission reductions but require widespread adoption and changes in behavior. These practices are effective in mitigating local environmental impacts.
  - **Transportation and Policy Measures:** Effective in reducing emissions from the transport sector and aligning economic interests with conservation goals. Policies and economic instruments provide the necessary framework for sustainable practices.

### **Transferability:**

- **Adaptation Measures:**
  - **Structural Measures:** Can be transferred to other coastal areas facing similar risks, though local environmental and socio-economic conditions must be considered. Measures like beach nourishment and dike heightening are applicable across different regions.
  - **Non-Structural Measures:** Highly transferable and can be adapted to different contexts with relative ease. Measures like climate services and communication strategies are universally applicable.
  - **Ecological Engineering:** Transferable with site-specific adaptations. Replanting vegetation and ecological engineering can be applied to similar ecosystems elsewhere.
  - **Socio-Economic Measures:** Transferable across different cultural and social contexts. Educational campaigns and public participation are universally beneficial.
- **Mitigation Measures:**

- **Renewable Energy and Energy Efficiency:** Transferable with appropriate technological and financial support. These measures can be implemented in various regions.
- **Sustainable Practices and Waste Management:** Transferable with adjustments for local socio-economic conditions. Practices like sustainable agriculture and improved waste management can be adopted in different regions.
- **Transportation and Policy Measures:** Transferable with policy and regulatory adjustments. Economic instruments and public transport promotion can be aligned with local economic structures and priorities.

#### Replicability:

- **Adaptation Measures:**
  - **Structural Measures:** Replicable with significant investment and logistical planning. Measures like super dikes require financial resources and technical expertise.
  - **Non-Structural Measures:** Highly replicable as they involve community engagement and regulatory support. Managed retreat and preparedness measures can be modeled in other regions.
  - **Ecological Engineering:** Replicable with local adaptations. Replanting vegetation and ecological engineering techniques are effective and sustainable.
  - **Socio-Economic Measures:** Easily replicable and essential for raising awareness and promoting behavioral change. Climate services and educational campaigns are universally relevant.
- **Mitigation Measures:**
  - **Renewable Energy and Energy Efficiency:** Replicable with sufficient investment and infrastructure development. These measures require technological support and financial resources.
  - **Sustainable Practices and Waste Management:** Replicable with community involvement and regulatory support. Encouraging sustainable practices and reducing plastic use are universally applicable.
  - **Transportation and Policy Measures:** Replicable with tailored economic policies. Implementing financial incentives and support requires alignment with local economic conditions.

### 3.2.5 Identification and Listing of Adaptation and Mitigation Measures: Case study Fehmarn, Germany: Coastal conflicts, climate impacts and adaptation<sup>7</sup>

#### Adaptation Measures:

1. **Ecosystem-based Adaptation:**
  - **Replanting Vegetation:** Enhancing coastal dune systems through vegetation.
  - **Buffer Zones:** Establishing buffer zones to protect against storm surges and flooding.
  - **Water Runoff Management:** Implementing strategies to manage water runoff and prevent erosion.
2. **Infrastructure Adaptation:**
  - **Construction of Dikes and Sea Walls:** Building physical barriers to protect against coastal flooding.

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<sup>7</sup> Costa, L., Arikas, D., Siegel, P., & Widderich, F. (2021). Case study Fehmarn, Germany: Coastal conflicts, climate impacts and adaptation. Interreg Baltic Sea Region Programme funded project Land-Sea-Act (R098) "Land-sea interactions advancing Blue Growth in Baltic Sea coastal areas". Output of Activity 2.4. Retrieved from <https://climate-adapt.eea.europa.eu/en/metadata/publications/coastal-conflicts-climate-impacts-and-adaptation-fehmarn-germany>)

- **Flood Barriers:** Installing barriers to manage and control floodwaters.
- **Removable Buildings:** Designing infrastructure that can be moved or dismantled in response to rising sea levels.
- 3. **Managed Retreat:**
  - **Strategic Relocation:** Moving infrastructure and communities away from high-risk coastal areas.
  - **Zoning Regulations:** Implementing zoning laws that prevent development in vulnerable areas.
- 4. **Community-Based Adaptation:**
  - **Engagement and Education:** Involving local communities in adaptation planning and raising awareness about climate change impacts.
  - **Resilience Building Programs:** Developing programs to increase community resilience to climate impacts.
- 5. **Early Warning Systems:**
  - **Real-Time Monitoring:** Using technology for real-time monitoring of weather and sea conditions.
  - **Communication Systems:** Developing robust communication systems to warn communities of impending storms or floods.

#### **Mitigation Measures:**

1. **Renewable Energy Integration:**
  - **Solar and Wind Energy:** Promoting the adoption of solar and wind energy technologies.
  - **Incentives for Renewables:** Providing financial incentives for households and businesses to invest in renewable energy.
2. **Energy Efficiency:**
  - **Building Standards:** Implementing energy efficiency standards for new and existing buildings.
  - **Transportation Efficiency:** Enhancing the efficiency of transportation systems to reduce emissions.
3. **Sustainable Land Use:**
  - **Sustainable Agriculture:** Promoting practices that reduce emissions from agriculture.
  - **Urban Green Spaces:** Increasing green spaces in urban areas to act as carbon sinks.
4. **Carbon Sequestration:**
  - **Reforestation:** Supporting reforestation projects to sequester carbon.
  - **Wetland Conservation:** Preserving wetlands to enhance their carbon storage capacity.
5. **Policy and Regulation:**
  - **Climate Policies:** Establishing policies that promote low-carbon development.
  - **Carbon Pricing:** Implementing carbon pricing mechanisms to reduce emissions.

#### **Analysis of Adaptation and Mitigation Measures**

##### **Effectiveness:**

- **Adaptation Measures:**
  - **Ecosystem-based Adaptation:** Effective in providing long-term resilience and promoting biodiversity. Enhances natural defense mechanisms against climate impacts.
  - **Infrastructure Adaptation:** Provides immediate protection against flooding and erosion but can be costly and may have long-term environmental impacts.
  - **Managed Retreat:** Reduces long-term risk by relocating vulnerable infrastructure. Requires significant planning and investment.



- **Community-Based Adaptation:** Highly effective in building local resilience and ensuring sustainable practices. Relies on strong community engagement.
- **Early Warning Systems:** Critical for immediate response to climate events, enhancing preparedness and reducing impacts on life and property.
- **Mitigation Measures:**
  - **Renewable Energy Integration:** Highly effective in reducing greenhouse gas emissions and enhancing energy security. Requires investment and infrastructure development.
  - **Energy Efficiency:** Effective in reducing emissions and saving costs. Implementation of strict standards and regulations is necessary.
  - **Sustainable Land Use:** Promotes carbon sequestration and reduces emissions from agriculture and urban areas.
  - **Carbon Sequestration:** Enhances natural carbon sinks through reforestation and wetland conservation. Long-term effectiveness in storing carbon.
  - **Policy and Regulation:** Provides a framework for low-carbon development and incentivizes emission reductions. Requires strong governance and enforcement.

#### Transferability:

- **Adaptation Measures:**
  - **Ecosystem-based Adaptation:** Highly transferable and replicable across different coastal regions. Adaptable to specific local ecosystems and conditions.
  - **Infrastructure Adaptation:** Transferable but requires financial investment and technical expertise. Suitable for regions with similar climate risks.
  - **Managed Retreat:** Transferable but challenging socially and politically. Requires community acceptance and financial support.
  - **Community-Based Adaptation:** Highly transferable and replicable with strong community involvement. Success depends on local social structures and governance.
  - **Early Warning Systems:** Transferable and replicable with the availability of technology and infrastructure. Requires investment in technology and training.
- **Mitigation Measures:**
  - **Renewable Energy Integration:** Transferable with appropriate technological and financial support. Can be implemented in various regions.
  - **Energy Efficiency:** Transferable with regulatory support and investment in infrastructure. Can be adopted in different contexts.
  - **Sustainable Land Use:** Transferable with adjustments for local conditions. Practices can be adopted in various regions.
  - **Carbon Sequestration:** Transferable with site-specific adaptations. Reforestation and wetland conservation can be implemented in different ecosystems.
  - **Policy and Regulation:** Transferable with appropriate governance structures. Carbon pricing and climate policies can be adopted in various regions.

#### Replicability:

- **Adaptation Measures:**
  - **Ecosystem-based Adaptation:** Highly replicable due to reliance on natural processes. Easily adapted to local conditions.
  - **Infrastructure Adaptation:** Replicable with significant investment and planning. Requires financial resources and technical expertise.
  - **Managed Retreat:** Replicable but requires careful planning and community engagement. Social and political challenges need to be addressed.
  - **Community-Based Adaptation:** Highly replicable with strong community engagement. Requires effective communication and education.

- **Early Warning Systems:** Replicable with investment in technology and training. Requires infrastructure for real-time monitoring and communication.
- **Mitigation Measures:**
  - **Renewable Energy Integration:** Replicable with sufficient investment and infrastructure development. Requires financial and technological support.
  - **Energy Efficiency:** Replicable with regulatory support and investment in infrastructure. Can be implemented in various contexts.
  - **Sustainable Land Use:** Replicable with adjustments for local conditions. Practices can be adopted in different regions.
  - **Carbon Sequestration:** Replicable with site-specific adaptations. Reforestation and wetland conservation can be implemented in different ecosystems.
  - **Policy and Regulation:** Replicable with appropriate governance structures. Carbon pricing and climate policies can be adopted in various regions.

### 3.2.6 Identification and Listing of Adaptation and Mitigation Measures: Integrating Climate Change Adaptation into Development Co-operation: Policy Guidance<sup>8</sup>

#### Adaptation Measures:

1. **Prevent Effects:**
  - **Changes in Crop Management Practices:** Adapting farming techniques to cope with changing climate conditions.
  - **Increased Irrigation Water:** Enhancing irrigation systems to ensure adequate water supply.
  - **Additional Fertilizer Use:** Using fertilizers to improve crop resilience and yield.
  - **Pest and Disease Control:** Implementing measures to control pests and diseases that may increase due to climate change.
2. **Change Use:**
  - **Substitution of More Drought-Tolerant Crops:** Switching to crops that can withstand drought conditions.
  - **Returning Cropland to Pasture or Forest:** Converting agricultural land to pasture or forest to reduce vulnerability.
3. **Change Location:**
  - **Relocation of Major Crops and Farming Regions:** Moving agricultural activities to areas less affected by climate change.
4. **Research:**
  - **Development of New Technologies and Methods of Adaptation:** Investing in research to find new ways to adapt to climate change.
5. **Encourage Behavioral Change:**
  - **Dissemination of Knowledge through Education and Public Information Campaigns:** Raising awareness and educating the public about climate change and adaptation strategies.

#### Mitigation Measures:

1. **Bear Losses:**
  - **Acceptance of Losses:** Accepting the inevitability of some losses when no capacity to respond exists.

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<sup>8</sup> OECD (2009), *Integrating Climate Change Adaptation into Development Co-operation: Policy Guidance*, OECD Publishing, Paris, <https://doi.org/10.1787/9789264054950-en>.

2. **Share Losses:**
  - **Public Relief, Rehabilitation, and Reconstruction:** Funding from public sources to aid recovery and rebuilding efforts.
  - **Insurance Mechanisms:** Developing insurance schemes to distribute the financial risk.
3. **Modify the Threat:**
  - **Flood Control Works:** Building infrastructure such as dams, dikes, and levees to manage flood risks.
  - **Reduction of GHGs:** Implementing measures to reduce greenhouse gas emissions and slow the rate of climate change.

## Analysis of Adaptation and Mitigation Measures

### Effectiveness:

- **Adaptation Measures:**
  - **Changes in Crop Management Practices:** Highly effective in enhancing resilience to climate variability. Requires continuous improvement and adaptation to new information.
  - **Increased Irrigation Water:** Effective in maintaining agricultural productivity but may strain water resources.
  - **Additional Fertilizer Use:** Improves crop yields but must be managed to avoid environmental degradation.
  - **Pest and Disease Control:** Crucial for maintaining crop health, requires integrated pest management strategies.
  - **Substitution of More Drought-Tolerant Crops:** Effective in reducing water use and maintaining productivity under drought conditions.
  - **Returning Cropland to Pasture or Forest:** Provides long-term environmental benefits and reduces vulnerability.
  - **Relocation of Major Crops and Farming Regions:** Effective but requires significant planning and resources.
  - **Development of New Technologies:** Essential for long-term adaptation and resilience.
  - **Dissemination of Knowledge:** Highly effective in changing behaviors and promoting sustainable practices.
- **Mitigation Measures:**
  - **Bear Losses:** Inevitably necessary in some situations but not a proactive strategy.
  - **Public Relief and Insurance Mechanisms:** Effective in spreading financial risk and aiding recovery. Requires robust financial systems.
  - **Flood Control Works:** Effective for specific risks but can be costly and environmentally impactful.
  - **Reduction of GHGs:** Essential for mitigating long-term climate change impacts. Requires coordinated global efforts.

### Transferability:

- **Adaptation Measures:**
  - **Changes in Crop Management Practices:** Transferable with adjustments for local climatic and soil conditions.
  - **Increased Irrigation Water:** Transferable but dependent on local water availability.
  - **Additional Fertilizer Use:** Transferable with consideration of local environmental impacts.
  - **Pest and Disease Control:** Universally applicable with region-specific adjustments.
  - **Substitution of More Drought-Tolerant Crops:** Highly transferable across regions facing drought.

- **Returning Cropland to Pasture or Forest:** Transferable but requires socio-economic adjustments.
- **Relocation of Major Crops:** Transferable with significant logistical and financial planning.
- **Development of New Technologies:** Transferable with investment in local research capabilities.
- **Dissemination of Knowledge:** Universally transferable, requiring tailored communication strategies.
- **Mitigation Measures:**
  - **Bear Losses:** Applicable universally but not an ideal strategy.
  - **Public Relief and Insurance Mechanisms:** Transferable with appropriate financial infrastructure.
  - **Flood Control Works:** Transferable but requires significant financial investment and technical expertise.
  - **Reduction of GHGs:** Globally transferable, requiring coordinated policy and regulatory frameworks.

#### Replicability:

- **Adaptation Measures:**
  - **Changes in Crop Management Practices:** Highly replicable with ongoing training and support.
  - **Increased Irrigation Water:** Replicable where water resources allow.
  - **Additional Fertilizer Use:** Replicable with appropriate environmental safeguards.
  - **Pest and Disease Control:** Easily replicable with regional adaptations.
  - **Substitution of More Drought-Tolerant Crops:** Highly replicable in drought-prone areas.
  - **Returning Cropland to Pasture or Forest:** Replicable with policy support.
  - **Relocation of Major Crops:** Replicable with substantial planning and investment.
  - **Development of New Technologies:** Replicable with investment in research and development.
  - **Dissemination of Knowledge:** Easily replicable with effective communication strategies.
- **Mitigation Measures:**
  - **Bear Losses:** Inevitably replicable but not preferred.
  - **Public Relief and Insurance Mechanisms:** Highly replicable with robust financial systems.
  - **Flood Control Works:** Replicable with adequate resources.
  - **Reduction of GHGs:** Replicable with global coordination and commitment.

### 3.2.7 Identification and Listing of Adaptation and Mitigation Measures: Water and climate change: Which adaptation strategy for the Mediterranean?<sup>9</sup>

#### Adaptation Measures:

1. **Prevent Effects:**
  - **Increase Reservoir Capacity:** Expanding storage capacity to manage water supply.
  - **Increase Transfers Between River Basins:** Redirecting water to areas of need.
  - **Implement Water Efficiency Schemes:** Reducing water usage through efficiency.
  - **Develop Wastewater Reuse and Desalination Systems:** Creating alternative water sources.
  - **Improve Efficiency of Irrigation Systems:** Enhancing irrigation methods to save water.

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<sup>9</sup> Dubreuil, C. (n.d.). Water and climate change: Which adaptation strategy for the Mediterranean? Plan Bleu. Retrieved from [https://planbleu.org/wp-content/uploads/2012/09/4pages\\_num23\\_eauCC\\_EN.pdf](https://planbleu.org/wp-content/uploads/2012/09/4pages_num23_eauCC_EN.pdf)

- **Scale-up Infrastructure and Structures:** Building higher seawalls and other protective infrastructure.
- **Construct Flood-Resistant Buildings:** Designing buildings to withstand floods.
- 2. **Policy, Regulatory, and Institutional Responses:**
  - **Drought Management Plan:** Creating strategies to handle drought conditions.
  - **Financial Incentive Programme to Save Irrigation Water:** Encouraging efficient water use through financial incentives.
  - **Change Design and Operation Standards for Structures:** Updating standards to reflect climate risks.
  - **Rationing and Change Water Pricing:** Implementing water rationing and pricing adjustments.
  - **Adopt New Decision-Making Methods:** Incorporating uncertainty into planning and decision-making.
- 3. **Change/Reorganize Uses and Activities:**
  - **Reallocate the Resource to Uses with More Added Value:** Prioritizing water use for high-value activities.
  - **Introduce Crops That Use Less Water or Are More Resistant to Drought:** Adopting drought-resistant crops.
  - **Move Businesses and Housing Away from Flood Plains:** Relocating infrastructure to safer areas.
- 4. **Research and Improve Climate Information:**
  - **Improve Capacity for Seasonal, Annual, and Decadal Climate Modelling:** Enhancing predictive capabilities.
  - **Develop Tools to Aid Decision-Making:** Creating decision-support tools linking climate and hydrological models.
  - **Set Up Early Warning Systems:** Establishing systems to warn of extreme weather events.
  - **Facilitate Production and Release of Climatic Data:** Making climate data accessible to policymakers and the public.
- 5. **Strengthen Capacities and Raise Awareness:**
  - **Lengthen Policymakers' Planning Timeframes:** Encouraging long-term planning.
  - **Strengthen Technical Capacities of Sector Professionals:** Building skills to manage major risks.
  - **Raise Awareness and Educate the Public:** Increasing public understanding of climate issues.

#### **Mitigation Measures:**

1. **Bear Risks and Losses:**
  - **Do Nothing:** Accepting losses when adaptation is not feasible.
2. **Share Risks and Losses:**
  - **Set Up Insurance Systems:** Developing financial mechanisms to share the risk.
  - **Diversify Drinking Water Supply Sources:** Reducing dependence on a single water source.
3. **Modify the Threat:**
  - **Flood Control Works:** Building dams, dikes, and levees to manage flood risks.
  - **Reduction of GHGs:** Implementing measures to reduce greenhouse gas emissions.

#### **Analysis of Adaptation and Mitigation Measures**

##### **Effectiveness:**

- **Adaptation Measures:**

- **Increase Reservoir Capacity:** Highly effective in managing water supply but requires significant investment.
- **Water Efficiency Schemes:** Effective in reducing water usage and saving resources.
- **Wastewater Reuse and Desalination:** Provides alternative water sources but can be costly.
- **Flood-Resistant Buildings:** Essential for reducing flood damage and protecting infrastructure.
- **Policy and Regulatory Responses:** Effective in creating a framework for adaptive management but require strong governance.
- **Reallocate Resource Uses:** Efficient use of resources can significantly enhance resilience.
- **Climate Information and Early Warning Systems:** Crucial for preparedness and timely response to climate events.
- **Education and Awareness:** Long-term effectiveness in promoting sustainable behaviors and practices.
- **Mitigation Measures:**
  - **Insurance Systems:** Effective in sharing financial risks and aiding recovery.
  - **Flood Control Works:** Highly effective in specific scenarios but requires substantial investment and maintenance.
  - **Reduction of GHGs:** Essential for mitigating long-term climate change impacts and requires global coordination.

#### Transferability:

- **Adaptation Measures:**
  - **Reservoir Capacity and Water Transfers:** Transferable with consideration of local hydrological conditions.
  - **Efficiency Schemes and Reuse Systems:** Universally applicable with appropriate technological adaptations.
  - **Flood-Resistant Infrastructure:** Transferable but depends on local construction standards and regulations.
  - **Policy and Regulatory Measures:** Transferable with adjustments for local governance structures.
  - **Research and Information Systems:** Transferable with investment in local research capabilities and technology.
- **Mitigation Measures:**
  - **Insurance Systems:** Transferable with robust financial and regulatory frameworks.
  - **Flood Control Works:** Transferable with significant financial and technical resources.
  - **GHG Reduction Measures:** Globally transferable with coordinated policy efforts.

#### Replicability:

- **Adaptation Measures:**
  - **Reservoir and Efficiency Measures:** Replicable with financial and technical support.
  - **Flood-Resistant Infrastructure:** Replicable with adherence to updated building codes and standards.
  - **Policy and Regulatory Responses:** Replicable with strong institutional support and governance.
  - **Research and Awareness Programs:** Easily replicable with commitment to long-term education and capacity building.
- **Mitigation Measures:**
  - **Insurance Systems:** Replicable with development of appropriate financial products and services.

- **Flood Control Works:** Replicable with sufficient funding and expertise.
- **GHG Reduction:** Replicable through international cooperation and technology transfer.

### 3.2.8 Analysis of Adaptation and Mitigation Measures: Regional climate change adaptation framework for the Mediterranean marine and coastal areas<sup>10</sup>

#### Adaptation Measures

##### 1. Sector-Specific Adaptation Measures:

- **Agriculture:**
  - Changing crop varieties and altering farming practices.
  - Developing heat- and drought-resistant crops.
  - Diversifying livelihoods.
- **Water Resources:**
  - Building flood defenses.
  - Enhancing water use efficiency.
  - Constructing new water reservoirs.
- **Infrastructure:**
  - Changing building codes.
  - Investing in air-conditioning.
  - Constructing sea walls.
- **Coastal Zones:**
  - Building flood defenses.
  - Enhancing coastal zone management practices.
- **Health:**
  - Enhancing public health systems.
  - Developing early warning systems for heatwaves and other climate-related health risks.

##### 2. General Adaptation Strategies:

- **Increase Flexibility:**
  - Use of management approaches that provide benefits under various conditions.
- **Reduce Stress:**
  - Reducing pollution or demand.
  - Enhancing capacity through education and information.
- **No Regrets Measures:**
  - Removing or limiting maladaptation.
  - Investments that enhance the adaptive capacity of society.

##### 3. Types of Adaptation Measures:

- **Bear Losses:**
  - Accepting and absorbing losses without taking action.
- **Share Losses:**
  - Distributing losses among a broader community (e.g., through insurance).
- **Modify the Threat:**
  - Implementing measures to reduce or control the environmental threat (e.g., flood control works).
- **Prevent Effects:**

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<sup>10</sup> UN Environment/MAP. (2017). *Regional climate change adaptation framework for the Mediterranean marine and coastal areas*. Athens, Greece: UN Environment/MAP.  
[https://wedocs.unep.org/bitstream/handle/20.500.11822/17500/rccaf\\_eng.pdf](https://wedocs.unep.org/bitstream/handle/20.500.11822/17500/rccaf_eng.pdf)

- Implementing measures to prevent the adverse effects of climate change (e.g., improved irrigation practices).
- **Change Use:**
  - Changing the use of resources or land to adapt to new conditions.
- **Change Location:**
  - Relocating activities to areas less vulnerable to climate change.
- **Research:**
  - Investing in research to develop new technologies and methods for adaptation.
- **Encourage Behavioral Change:**
  - Promoting education and information campaigns to change behaviors and practices.

### **Mitigation Measures**

1. **Reducing Greenhouse Gas Emissions:**
  - Transitioning to renewable energy sources.
  - Improving energy efficiency in buildings and transportation.
  - Implementing carbon pricing mechanisms.
2. **Enhancing Carbon Sinks:**
  - Protecting and expanding forests and wetlands.
  - Promoting sustainable land use and agricultural practices.
  - Enhancing soil carbon storage through improved agricultural practices.
3. **Technological Innovations:**
  - Developing and deploying low-carbon technologies.
  - Investing in research and development for carbon capture and storage (CCS).
  - Promoting the use of electric vehicles and other low-emission transportation options.

### **Effectiveness of Adaptation and Mitigation Measures**

- **Agricultural Adaptation:**
  - Measures like developing drought-resistant crops and altering farming practices are effective in ensuring food security and sustaining livelihoods in the face of climate change. These practices are particularly relevant for regions facing increasing temperatures and changing precipitation patterns.
- **Water Resource Management:**
  - Building new reservoirs and enhancing water use efficiency are crucial for regions experiencing variable rainfall and water scarcity. These measures are effective in ensuring a stable water supply for both agricultural and domestic use.
- **Infrastructure Adaptation:**
  - Updating building codes and constructing sea walls are essential for protecting coastal areas from rising sea levels and extreme weather events. These measures enhance the resilience of communities and infrastructure to climate impacts.
- **Health Sector Adaptation:**
  - Enhancing public health systems and developing early warning systems are critical for mitigating the health impacts of climate change, such as heatwaves and vector-borne diseases.

### **Transferability and Replicability**

- **Agricultural and Water Management Practices:**
  - These practices are highly transferable across different regions facing similar climatic challenges. Techniques developed for drought-resistant crops or efficient water use can be adapted to local conditions in other regions.



- **Infrastructure and Coastal Zone Management:**
  - Measures like building sea walls and updating building codes can be replicated in coastal areas worldwide. However, local conditions and resources must be considered to ensure effectiveness.
- **Health Sector Measures:**
  - Public health interventions and early warning systems can be adapted to various contexts, especially in regions prone to heatwaves and other climate-related health risks.

### 3.2.9 Identification and Listing of Adaptation and Mitigation Measures: Climate and Development: An Agenda for Action - Emerging Insights from World Bank Group 2021-22 Country Climate and Development Reports<sup>11</sup>

#### **Adaptation Measures:**

1. **Flood Defences:**
  - **Sea Walls and Dikes:** Constructing physical barriers to protect against sea-level rise and storm surges.
2. **Water Management:**
  - **Enhanced Water Use Efficiency:** Implementing technologies and practices to reduce water consumption.
  - **New Water Reservoirs:** Building reservoirs to store water during periods of excess for use during droughts.
3. **Agricultural Adjustments:**
  - **Heat- and Drought-Resistant Crops:** Developing and planting crop varieties that can withstand higher temperatures and lower water availability.
  - **Improved Crop Management Practices:** Altering farming techniques to better cope with changing climate conditions.
4. **Urban Planning:**
  - **Climate-Proof Building Standards:** Updating building codes to ensure structures can withstand climate impacts.
  - **Strategic Land-Use Planning:** Planning urban development to avoid high-risk areas and integrate green spaces.
5. **Ecosystem Management:**
  - **Coastal Ecosystem Protection:** Preserving and restoring natural coastal barriers such as mangroves and wetlands.
  - **Promotion of Biodiversity:** Encouraging diverse ecosystems to enhance resilience to climate impacts.
6. **Public Awareness and Education:**
  - **Educational Initiatives:** Programs to increase public knowledge about climate change and adaptation strategies.
  - **Behavioral Change Campaigns:** Initiatives to promote sustainable behaviors among the public.

#### **Mitigation Measures:**

1. **Renewable Energy:**

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<sup>11</sup> World Bank Group. 2022. Climate and Development: An Agenda for Action - Emerging Insights from World Bank Group 2021-22 Country Climate and Development Reports. Washington, DC: World Bank. <http://hdl.handle.net/10986/38220>.

- **Wind and Solar Energy:** Promoting the development and use of renewable energy sources.
- 2. **Energy Efficiency:**
  - **Energy-Saving Technologies:** Implementing technologies to reduce energy consumption in buildings and industries.
- 3. **Transportation:**
  - **Public Transportation:** Encouraging the use of public transit to reduce emissions from private vehicles.
  - **Cycling and Walking Infrastructure:** Developing infrastructure to support low-emission modes of transport.
- 4. **Waste Management:**
  - **Recycling and Waste Reduction:** Improving recycling processes and reducing waste generation.
- 5. **Sustainable Agriculture:**
  - **Low-Emission Agricultural Practices:** Adopting farming techniques that reduce greenhouse gas emissions.

### **Analysis of Adaptation and Mitigation Measures**

#### **Effectiveness:**

- **Adaptation Measures:**
  - **Flood Defences:** Highly effective in protecting coastal areas from immediate threats such as storm surges and rising sea levels.
  - **Water Management:** Essential for maintaining water security in regions facing increased droughts. Both efficiency improvements and new reservoirs are effective strategies.
  - **Agricultural Adjustments:** Crucial for ensuring food security. Heat- and drought-resistant crops and improved management practices help maintain productivity.
  - **Urban Planning:** Effective in reducing vulnerability to climate impacts by ensuring buildings and infrastructure are resilient.
  - **Ecosystem Management:** Enhances natural resilience to climate impacts. Coastal ecosystems provide natural barriers and promote biodiversity.
  - **Public Awareness and Education:** Long-term effectiveness in promoting sustainable practices and supporting adaptation measures through informed public engagement.
- **Mitigation Measures:**
  - **Renewable Energy:** Effective in reducing greenhouse gas emissions and dependence on fossil fuels.
  - **Energy Efficiency:** Reduces energy consumption and emissions, providing both environmental and economic benefits.
  - **Transportation:** Reduces emissions from one of the largest contributing sectors. Public transport and active transport infrastructure are key.
  - **Waste Management:** Reduces methane emissions from landfills and promotes circular economy practices.
  - **Sustainable Agriculture:** Low-emission practices reduce the agricultural sector's impact on climate change.

#### **Transferability:**

- **Adaptation Measures:**
  - **Flood Defences:** Transferable to other coastal areas but requires significant investment and technical expertise.
  - **Water Management:** Practices such as enhancing water efficiency and building reservoirs are transferable but must be tailored to local conditions.

- **Agricultural Adjustments:** Techniques for developing resilient crops and improved practices can be adapted to different regions.
- **Urban Planning:** Climate-proof standards can be incorporated globally, though they require regulatory support.
- **Ecosystem Management:** Principles are broadly applicable, but specific strategies must consider local ecological contexts.
- **Public Awareness and Education:** Transferable through tailored educational campaigns and community programs.
- **Mitigation Measures:**
  - **Renewable Energy:** Transferable with appropriate technological and financial support.
  - **Energy Efficiency:** Universally applicable with investment in technology and regulatory frameworks.
  - **Transportation:** Transferable with infrastructural investment and policy support.
  - **Waste Management:** Transferable with appropriate waste management infrastructure.
  - **Sustainable Agriculture:** Transferable with adjustments for local farming practices and conditions.

#### Replicability:

- **Adaptation Measures:**
  - **Flood Defences:** Replicable with sufficient funding and expertise.
  - **Water Management:** Replicable in regions facing water scarcity with appropriate investment.
  - **Agricultural Adjustments:** High replicability in agricultural regions with support for research and development.
  - **Urban Planning:** Replicable with governance and regulatory frameworks.
  - **Ecosystem Management:** Replicable through conservation programs and policies.
  - **Public Awareness and Education:** Easily replicable with institutional support and public engagement.
- **Mitigation Measures:**
  - **Renewable Energy:** Replicable with investment and technology transfer.
  - **Energy Efficiency:** Replicable with policy support and infrastructure investment.
  - **Transportation:** Replicable with funding for infrastructure and policy incentives.
  - **Waste Management:** Replicable with development of appropriate systems.
  - **Sustainable Agriculture:** Replicable with support for sustainable practices and technology adoption.

### 3.2.10 Identification and Listing of Adaptation and Mitigation Measures: Recommendations for the transition to a green travel and tourism economy<sup>12</sup>

#### 1. Adaptation Measures:

##### 1. Ecological Beach Model:

- Implementation of integrated management models for posidonia deposits, promoting the preservation of beach casts on-site.
- Awareness-raising activities for students, tourists, public administrations, and beach managers.

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<sup>12</sup> World Tourism Organization. (2021). Recommendations for the transition to a green travel and tourism economy. UNWTO. <https://doi.org/10.18111/9789284422814> Retrieved from [https://webunwto.s3.eu-west-1.amazonaws.com/s3fs-public/2021-05/210504-Recommendations-for-the-Transition-to-a-Green-Travel-and-Tourism-Economy.pdf?wiwmhIGgXT4zwXles\\_Q8ycdITGIQfaMt](https://webunwto.s3.eu-west-1.amazonaws.com/s3fs-public/2021-05/210504-Recommendations-for-the-Transition-to-a-Green-Travel-and-Tourism-Economy.pdf?wiwmhIGgXT4zwXles_Q8ycdITGIQfaMt)

- Balancing natural and anthropic elements for best coastal preservation.
- 2. **Nature-based Solutions:**
  - Investment in nature-based solutions like wetlands, mangroves, and posidonia meadows to drive innovation towards sustainability and manage natural resources.
  - The Red Sea Project: Grounded in environmental considerations, incorporating eco-friendly designs and conservation efforts.
- 3. **Restoration Projects:**
  - Restoration of high carbon density ecosystems, like kelp forests, for carbon removal and reversing climate change effects.
  - Iberostar’s mangrove restoration in Mexico to offset carbon footprint and build destination resilience.

## 2. Mitigation Measures:

1. **Circular Economy:**
  - Reducing and reusing processes, recycling, and resource efficiency to promote sustainable tourism value chains.
  - TUI Group’s initiatives to reduce single-use plastic, food waste, and increase renewable energy usage.
2. **Carbon Neutrality and Decarbonization:**
  - VisitScotland’s low-carbon pathway integrating sustainability in tourism operations.
  - Valencia’s roadmap for becoming a carbon-neutral destination by 2025, including footprint calculation, digital management systems, and compensation projects.
3. **CO2 Emissions Monitoring:**
  - Strengthening measurement and disclosure of CO2 emissions from tourism operations.
  - Promoting science-based targets and monitoring mechanisms to shift towards climate-aware tourism development.

## 3. Analysis of Effectiveness, Transferability, and Replicability:

1. **Effectiveness:**
  - The ecological beach model and nature-based solutions are effective in protecting coastal ecosystems and promoting biodiversity. These measures help in mitigating coastal erosion and enhancing disaster resilience.
  - Circular economy initiatives and carbon neutrality projects have shown significant reductions in waste and CO2 emissions, contributing to more sustainable tourism operations.
2. **Transferability:**
  - Many of these practices, such as the ecological beach model and nature-based solutions, can be transferred to other coastal Mediterranean destinations facing similar environmental challenges.
  - Circular economy processes and carbon neutrality efforts can be adapted by various tourism stakeholders, given the availability of appropriate resources and regulatory support.
3. **Replicability:**
  - The awareness-raising components and integrated management models for ecological beaches can be replicated in other regions with similar coastal dynamics.
  - Restoration projects like kelp forest regeneration and mangrove protection offer scalable solutions that can be implemented in other coastal areas with minor adjustments based on local ecological conditions.

- Carbon monitoring and circular economy frameworks require collaboration among local governments, tourism operators, and the community, ensuring the replicability of these practices with sufficient stakeholder engagement.

**3.2.11 Identification and Listing of Adaptation and Mitigation Measures:** Mediterranean experience of ecotourism (MEET) manual: Ecotourism in Mediterranean destinations: From monitoring and planning to promotion and policy support<sup>13</sup>

**Adaptation Measures:**

**1. Food & Drinks:**

- **Lower Protein-Intensive Foods:** Shifting to vegetables, legumes, and cereals to reduce the carbon footprint.
- **Reduce Food Caloric Provision:** Providing fewer calories to tourists.
- **Local Food Products:** Increasing the share of locally sourced food.

**2. Accommodation:**

- **Small-Scale Traditional Facilities:** Utilizing accommodations that incorporate alternative energy sources like photovoltaic panels.

**3. Mobility & Transfers:**

- **Local Public Transportation:** Encouraging the use of public transport for tourist transfers.
- **Hybrid Electric Vehicles:** Using hybrid or highly efficient motor vehicles when public transportation is not feasible.

**4. Activities & Services:**

- **Minimize Vehicle Use:** Avoiding motor vehicle use in tourism activities.
- **Reduce Staff Involvement:** Limiting the number of employees involved to decrease the ecological footprint.

**Mitigation Measures:**

**1. Conservation and Sustainability:**

- **Environmental Sustainability Criteria:** Ensuring all tourism supply chain components comply with sustainability standards.
- **Protected Area Rules:** Sharing and explaining park rules, designated trails, and goals with travelers.
- **Waste Minimization:** Avoiding disposable plastics and over-packaging.
- **Sustainable Transportation:** Using electric cars, bicycles, or walking.
- **Resource Efficiency:** Reducing energy and water usage with measures like LED lamps and water-saving devices.
- **Wildlife Protection:** Avoiding locations that sell endangered or rare wild animals and plants.

**2. Socio-Economic Sustainability:**

- **Fair Working Conditions:** Supporting fair wages, reducing seasonal labor, and opposing illegal labor.

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<sup>13</sup> WWF Mediterranean. (2022). Mediterranean experience of ecotourism (MEET) manual: Ecotourism in Mediterranean destinations: From monitoring and planning to promotion and policy support. DestiMED PLUS Project. Contributions from IUCN-Med, CPMR, with support from D. Noll and A. Scott (Uncornered Market). InterregMED Programme – DestiMED Plus Project, Work Package WP2, Deliverable 2.2.6. Retrieved from [https://destimed-plus.interreg-med.eu/fileadmin/user\\_upload/Sites/Sustainable\\_Tourism/Projects/DESTIMED\\_PLUS/MEET\\_Manual\\_UPDATE.pdf](https://destimed-plus.interreg-med.eu/fileadmin/user_upload/Sites/Sustainable_Tourism/Projects/DESTIMED_PLUS/MEET_Manual_UPDATE.pdf)

- **Health and Safety Compliance:** Adhering to local regulations and providing protective gear.
- **Worker Training Programs:** Implementing training programs and ensuring high local employment.
- **Local Capacity Building:** Supporting local capacity building and monitoring tourism's impact on communities.

## Analysis of Adaptation and Mitigation Measures

### Effectiveness:

- **Adaptation Measures:**
  - **Local Food Products and Lower Protein-Intensive Foods:** Effective in reducing the carbon footprint and supporting local economies.
  - **Alternative Energy in Accommodation:** Significantly reduces greenhouse gas emissions.
  - **Hybrid Electric Vehicles:** Efficient in cutting down emissions from transportation.
  - **Minimizing Vehicle Use:** Reduces ecological footprint and promotes sustainable tourism activities.
- **Mitigation Measures:**
  - **Environmental Sustainability Criteria:** Ensures long-term conservation and sustainability of tourism practices.
  - **Waste Minimization:** Effective in reducing environmental pollution.
  - **Sustainable Transportation:** Reduces emissions from transport activities.
  - **Resource Efficiency:** Reduces consumption of energy and water, promoting sustainability.
  - **Wildlife Protection:** Contributes to the conservation of biodiversity.
  - **Fair Working Conditions and Local Employment:** Enhances socio-economic sustainability and community support.

### Transferability:

- **Adaptation Measures:**
  - **Local Food Products and Lower Protein-Intensive Foods:** Transferable to other regions with similar environmental conditions.
  - **Alternative Energy in Accommodation:** Applicable in various settings where renewable energy can be harnessed.
  - **Hybrid Electric Vehicles and Public Transportation:** Transferable to regions with existing infrastructure for hybrid vehicles and public transport.
  - **Minimizing Vehicle Use:** Universally applicable in promoting sustainable tourism practices.
- **Mitigation Measures:**
  - **Environmental Sustainability Criteria:** Transferable across different ecotourism operations globally.
  - **Waste Minimization:** Universally applicable and easily adoptable.
  - **Sustainable Transportation:** Transferable with infrastructural support.
  - **Resource Efficiency:** Universally applicable with appropriate technology.
  - **Wildlife Protection:** Transferable with local adaptations.
  - **Fair Working Conditions and Local Employment:** Transferable with support from local governments and organizations.

### Replicability:

- **Adaptation Measures:**
  - **Local Food Products and Lower Protein-Intensive Foods:** Highly replicable with community engagement.

- **Alternative Energy in Accommodation:** Replicable with investment in renewable energy infrastructure.
- **Hybrid Electric Vehicles:** Replicable with financial and technical support.
- **Minimizing Vehicle Use:** Easily replicable with policy support.
- **Mitigation Measures:**
  - **Environmental Sustainability Criteria:** Easily replicable with regulatory frameworks.
  - **Waste Minimization:** Highly replicable with public awareness campaigns.
  - **Sustainable Transportation:** Replicable with investment in infrastructure.
  - **Resource Efficiency:** Replicable with appropriate technology and policy support.
  - **Wildlife Protection:** Replicable with conservation programs.
  - **Fair Working Conditions and Local Employment:** Replicable with strong governance and community support.

**3.2.12 Identification and Listing of Adaptation and Mitigation Measures:** Climate action through regeneration: Unlocking the power of communities and nature through tourism<sup>14</sup>

**Identified Adaptation and Mitigation Practices:**

1. **Center Community Needs First:**
  - Understand and document societal challenges.
  - Adopt a living systems approach recognizing complex interactions within the destination.
  - Document changes and trade-offs in human well-being outcomes due to tourism interventions.
2. **Improve Ecosystem Integrity and Biodiversity:**
  - Monitor ecosystem changes over time and adapt as needed.
  - Use tourism as a tool to finance and facilitate ecosystem restoration and protection.
  - Engage residents, visitors, and employees in ecosystem and biodiversity work through educational opportunities, citizen science, and sharing lessons learned.
3. **Develop Transparent Governance Structures:**
  - Engage stakeholders continuously and establish processes for community feedback.
  - Uphold indigenous and community rights to land and resources.
  - Ensure communities have access to vital natural and cultural assets.
4. **Embrace Diverse and Inclusive Business Models:**
  - Diversify revenue streams to improve business and Nature-based Solutions (NbS) viability.
  - Retain and support talent through enhanced training and employment opportunities.
  - Embrace inclusivity and diversity in partnerships, employment, and marketing strategies.
5. **Enhance Regenerative Partnerships:**
  - Act as a bridge between communities and government for social and ecological regeneration.
  - Partner with NGOs and government for management, monitoring, and reporting.
  - Contribute to national and global targets for human well-being, climate change, biodiversity, and human rights to scale best practices.

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<sup>14</sup> King, C., & Burns, O. (2022). Climate action through regeneration: Unlocking the power of communities and nature through tourism. Regenerative Travel, Solimar International, and University of Edinburgh. Washington, D.C., USA and Edinburgh, Scotland, UK. Retrieved from <https://climate-adapt.eea.europa.eu/en/metadata/publications/climate-action-through-regeneration-unlocking-the-power-of-communities-and-nature-through-tourism>

## Key Insights:

1. **Effectiveness:**
  - The practices emphasize a holistic approach where community needs are integrated into conservation and climate initiatives. By aligning societal challenges with environmental goals, these practices ensure long-term sustainability and community support.
2. **Transferability:**
  - The principles and practices highlighted can be adapted to various contexts, making them highly transferable. The focus on community engagement, transparent governance, and diverse business models are universal strategies that can be implemented in different regions.
3. **Replicability:**
  - The documented practices and principles provide a clear framework that can be replicated by other tourism businesses and destinations. The inclusion of case studies and detailed actions offers practical examples and guidance for implementation.
4. **Community-Centered Approach:**
  - Centering community needs ensures that conservation efforts are supported by local populations. This increases the likelihood of long-term success and creates a sense of ownership and responsibility among community members.
5. **Ecosystem-Based Management:**
  - The emphasis on ecosystem integrity and biodiversity highlights the importance of maintaining healthy ecosystems for both climate mitigation and adaptation. This approach leverages tourism as a means to fund and promote ecological restoration and protection.
6. **Inclusive Governance and Partnerships:**
  - Developing transparent governance structures and enhancing regenerative partnerships fosters collaboration and accountability. This inclusive approach ensures that all stakeholders are involved in decision-making processes and that the benefits of tourism are equitably distributed.
7. **Diverse and Resilient Business Models:**
  - Encouraging diverse and inclusive business models strengthens the resilience of tourism businesses. By diversifying revenue streams and embracing inclusivity, businesses can better withstand economic shocks and contribute to broader social and environmental goals.

## 3.3 Synthesis of the analysis: Key Insights on Climate Change Adaptation and Mitigation Practices for Coastal Mediterranean

### Adaptation Measures

1. **Natural Evolution Under Monitoring**
  - **Surveillance/Observation Network:** Implementing monitoring tools to acquire knowledge about physical processes is crucial. Regular monitoring allows for timely responses to changes and helps understand long-term trends.
  - **Flexible/Reversible Measures:** These actions, which can be easily reversed without significant financial impact, provide adaptability in changing conditions.
2. **Accompaniment of Natural Processes**
  - **Dune Management:** Managing sand dunes through replanting vegetation or using ecological engineering methods to stabilize sand and control erosion. This promotes natural barriers against coastal erosion.



- **Marsh and Cliff Management:** Flexible management techniques help control erosion in these sensitive areas, maintaining their ecological balance.
- 3. **Hazard Mitigation**
  - **Flood Runoff Control:** Strategic measures to control runoff and mitigate flooding are essential in reducing the impact of heavy rainfall.
  - **Water Evacuation Systems:** Effective systems to prevent water from entering flood-prone areas or to evacuate water efficiently during floods.
- 4. **Soft Engineering**
  - **Beach Nourishment:** Adding sand to beaches to combat erosion and maintain beach profiles helps in preserving the recreational and protective functions of beaches.
  - **Ecological Engineering:** Using natural materials and processes to stabilize beaches and dunes fosters a more sustainable and resilient coastline.
- 5. **Hard Engineering**
  - **Sea Walls and Breakwaters:** Constructing physical barriers to protect against coastal erosion and storm surges provides immediate protection but may have long-term negative impacts on natural processes.
  - **Erosion Control Structures:** Installing structures to prevent or slow down coastal erosion, complementing natural defenses.
- 6. **Reducing Vulnerability**
  - **Removable Buildings:** Constructing buildings that can be moved or dismantled in response to changing environmental conditions offers flexibility and reduces long-term risk.
  - **Crisis Preparation:** Enhancing community resilience through preparation and planning for potential disasters ensures better preparedness and response.
- 7. **Complementary Measures**
  - **Education and Awareness:** Programs to raise awareness and educate the public about coastal risks and adaptation strategies.
  - **Urban Planning:** Integrating climate change considerations into urban planning and development regulations.
  - **Financial Incentives:** Providing incentives such as subsidies and tax breaks to encourage adaptation efforts.
  - **Climate Services and Information:** Creating services to provide climate-related information to citizens and stakeholders.

## Mitigation Measures

1. **Greenhouse Gas Reduction**
  - **Renewable Energy Sources:** Promoting the use of renewable energy reduces dependence on fossil fuels and lowers greenhouse gas emissions.
  - **Energy Efficiency:** Implementing measures to improve energy efficiency in buildings, transport, and industry reduces overall energy consumption.
  - **Carbon Sequestration:** Enhancing natural carbon sinks through reforestation and conservation of wetlands and other ecosystems.
2. **Sustainable Practices**
  - **Sustainable Agriculture:** Practices that reduce emissions from agricultural activities.
  - **Waste Management:** Improving waste management practices to reduce methane emissions from landfills.
3. **Transportation**

- **Public Transport Promotion:** Encouraging the use of public transport reduces emissions from private vehicles.
  - **Electric Vehicles:** Promoting the adoption of electric vehicles to reduce emissions from transport.
4. **Policy and Legislation**
- **Climate Policies:** Developing and enforcing policies that limit emissions and promote sustainable practices.
  - **Economic Instruments:** Using tools such as carbon pricing, taxes, and subsidies to incentivize emission reductions.

### Analysis of Effectiveness, Transferability, and Replicability

#### Effectiveness

- **Adaptation Measures:** Measures like beach nourishment and dune management are effective in the short to medium term but require regular maintenance. Hard engineering solutions provide immediate protection but can have long-term negative impacts on natural processes.
- **Mitigation Measures:** Renewable energy and energy efficiency measures are highly effective in reducing GHG emissions and have long-term benefits. Sustainable practices in agriculture and waste management contribute significantly to emission reductions but require widespread adoption and behavioral changes.

#### Transferability

- **Adaptation Measures:** Natural process-based measures like dune management and beach nourishment are transferable across different coastal contexts. Hard engineering solutions may be less transferable due to varying coastal dynamics and environmental impacts.
- **Mitigation Measures:** Renewable energy technologies and energy efficiency measures are highly transferable as they can be implemented in various regions with appropriate technological and financial support.

#### Replicability

- **Adaptation Measures:** Ecological engineering and flexible management measures are easily replicable in different coastal areas. Complementary measures like education, urban planning, and financial incentives require strong institutional support.
- **Mitigation Measures:** Practices such as renewable energy adoption and energy efficiency improvements are replicable with sufficient investment. Sustainable agricultural practices and improved waste management systems depend on local agricultural practices and infrastructure.

## 3.4 Application to Criteria Development for Climate Change Adaptation and Mitigation in Coastal Tourism

The insights derived from the comprehensive analysis of adaptation and mitigation measures have provided a robust foundation for the development of criteria by emphasizing key factors such as **effectiveness**, **transferability**, and **replicability**. These insights ensure that the criteria developed are **practical**, **actionable**, and **tailored** to the specific needs of coastal Mediterranean tourism destinations.

**Effectiveness of Measures** is a crucial aspect highlighted in the analysis. It identifies both short-term and long-term impacts of various adaptation and mitigation strategies. For instance, hard engineering solutions like sea walls offer immediate protection against coastal erosion and storm surges, making them effective in the short term. In contrast, long-term solutions such as ecological engineering and flexible management approaches adapt to evolving conditions, providing sustainable resilience over time. The analysis underscores the importance of a **holistic approach**, integrating **environmental sustainability** with **economic viability** and **socio-cultural integrity**. Measures like beach nourishment, which combats erosion

while maintaining the aesthetic and recreational value of beaches, support the local tourism economy, demonstrating their multifaceted effectiveness.

**Transferability Across Regions** is another key insight from the analysis. Natural process-based solutions, such as dune management and beach nourishment, are adaptable across various coastal contexts due to their reliance on natural processes. These solutions can be applied in different regions with similar environmental conditions, ensuring broad applicability. Furthermore, the analysis highlights the necessity of **policy and regulatory support**. Effective adaptation and mitigation strategies often require strong governance, such as urban planning and crisis preparation measures, which can be incorporated into local regulatory frameworks, making them transferable across different jurisdictions.

The analysis also emphasizes the **replicability of practices**. Standardized protocols and techniques, such as research and monitoring initiatives, are easily replicable due to their uniform nature. Practices like surveillance networks and climate services can be implemented in different regions, contributing to a broader understanding and response to climate impacts. Additionally, measures involving **community engagement and education**, such as citizen science programs and educational campaigns, are universally replicable. These initiatives build local capacity and ensure that sustainable practices are maintained over time.

Integration of **proven practices** is another significant insight from the analysis. By examining successful case studies from within and outside the Mediterranean region, the criteria development process integrates adaptation and mitigation practices that have demonstrated success in real-world scenarios. This ensures that the criteria are grounded in **practical, actionable insights**. The analysis also underscores the role of **technology and innovation** in enhancing resilience. Measures such as real-time weather monitoring systems and the adoption of renewable energy sources highlight the importance of innovative solutions that can be replicated and scaled.

A focus on **specific needs and challenges** unique to coastal Mediterranean destinations ensures that the criteria address the particular conditions and risks faced by these regions. The analysis identifies specific needs and challenges, such as the high vulnerability to sea-level rise and storm surges. This targeted approach ensures that the criteria are relevant and effective. Additionally, the analysis highlights existing barriers, such as financial constraints and lack of technical expertise, informing the development of criteria that include support mechanisms like financial incentives and capacity-building programs.

**Stakeholder engagement and inclusivity** are also emphasized in the analysis. Engaging a wide range of stakeholders, from local governments to community representatives, ensures that the criteria reflect diverse perspectives and needs. This inclusivity fosters **buy-in** and **relevance**, making the criteria more likely to be accepted and implemented. Moreover, the analysis underscores the importance of **community-based approaches** in planning and implementing adaptation and mitigation measures. Involving local communities not only enhances the effectiveness of these measures but also ensures they are culturally appropriate and supported by the community.

By leveraging these insights, the criteria development process for climate change adaptation and mitigation in coastal tourism destinations will produce a robust, comprehensive framework. This framework will guide the Mediterranean region's coastal tourism destinations in implementing effective, transferable, and replicable strategies that enhance resilience to climate impacts and contribute to global emission reduction efforts.

## 4. Findings from Stakeholder Engagement

This analysis emerges from the stakeholder survey conducted as part of Activity 1.3. The survey, coupled with individual consultations, aimed to gather insights on stakeholder perspectives, identify challenges and barriers to climate change adaptation in coastal tourism, and explore opportunities and best practices. The findings are summarized below:

**Stakeholder Perspectives:** Stakeholders from various Mediterranean destinations provided key insights into the perceived impacts of climate change on the tourism sector. The majority emphasized the growing concern over extreme weather events, resource scarcity, and rising temperatures. These changes are already altering tourism patterns, extending seasons, and creating new challenges for local communities and infrastructure. Stakeholders expressed a range of perspectives on the effectiveness of current policies and initiatives, with some noting significant gaps in long-term planning and enforcement.

**Identified Challenges and Barriers:** Several common challenges and barriers were highlighted by stakeholders, including:

- **Coordination and Consistency:** Ensuring consistent application of climate adaptation criteria across different governance levels remains a significant challenge. Effective communication and collaboration between local and regional authorities are crucial but often lacking.
- **Resource Allocation:** Financial constraints and unequal distribution of resources were frequently mentioned as major obstacles. Many destinations struggle to secure sustainable funding for comprehensive climate action plans.
- **Capacity Building:** The need for continuous education and training was emphasized, with stakeholders pointing out significant knowledge gaps and limited technical expertise.
- **Community Engagement:** Engaging local communities and overcoming socio-cultural resistance to change are critical yet challenging aspects of implementing climate strategies.
- **Policy and Governance:** Navigating complex political environments and aligning local policies with broader regional and national frameworks pose substantial barriers.
- **Monitoring and Evaluation:** Developing effective monitoring systems and ensuring adaptive management practices are key challenges that need to be addressed for ongoing improvement.

**Opportunities and Best Practices:** Stakeholders suggested several opportunities for improvement and shared best practices that have shown promise in their regions:

- **Strengthening Coordination:** Establishing multi-stakeholder platforms and fostering partnerships can enhance alignment and cooperation between local and regional efforts.
- **Securing Funding:** Exploring diverse sources of funding, including public-private partnerships, international aid, and climate finance mechanisms, is essential to address financial constraints.
- **Building Capacity:** Implementing comprehensive training programs and knowledge-sharing initiatives can bridge existing knowledge gaps and improve local capacities.
- **Community Engagement:** Developing targeted awareness campaigns and inclusive engagement strategies can foster community buy-in and active participation in climate initiatives.
- **Enhancing Policy Frameworks:** Advocating for supportive policies and streamlined governance processes can create an enabling environment for effective climate action.

- **Implementing Robust Monitoring Systems:** Developing clear indicators and leveraging technology for data collection can strengthen monitoring and evaluation efforts, ensuring continuous improvement and adaptation of strategies.

### **Overall conclusion**

The insights gathered from the stakeholder engagement process underscore the complexity and urgency of addressing climate change impacts on coastal tourism in the Mediterranean. Stakeholders have vividly described the pressing challenges posed by extreme weather events, resource scarcity, and rising temperatures, all of which are already altering tourism patterns and placing additional strain on local communities and infrastructure. The identified challenges highlight the need for coordinated efforts across various governance levels to ensure consistent application of climate adaptation criteria. This requires not only robust communication and collaboration among local and regional authorities but also significant improvements in resource allocation to overcome financial constraints and ensure equitable distribution of resources.

Capacity building emerged as a crucial need, with stakeholders emphasizing the importance of continuous education and training to address knowledge gaps and enhance technical expertise. Community engagement was also identified as a critical component, as successful implementation of climate strategies hinges on overcoming socio-cultural resistance and fostering inclusive participation from all community members. Additionally, navigating the complexities of policy and governance, including aligning local policies with regional and national frameworks, remains a substantial barrier that must be addressed.

The suggested best practices offer a viable pathway to overcoming these barriers and achieving sustainable climate action. By strengthening coordination through multi-stakeholder platforms, exploring diverse funding sources, implementing comprehensive training programs, and developing targeted awareness campaigns, stakeholders can enhance resilience and adaptation efforts. Moreover, advocating for supportive policies and creating streamlined governance processes can establish an enabling environment for effective climate action. Implementing robust monitoring systems with clear indicators and leveraging technology for data collection will further ensure continuous improvement and adaptation of strategies.

These findings will inform the criteria development process outlined in the following sections, ensuring that the standardized and harmonized criteria for climate change adaptation and mitigation in coastal tourism are not only robust and actionable but also responsive to the real-world challenges and opportunities identified by stakeholders. The incorporation of stakeholder insights into the criteria development process will help tailor these criteria to address the specific needs and conditions of different regions and destinations within the Mediterranean. Moving forward, these findings will guide the development of comprehensive regional and destination-specific strategies and plans, fostering a more resilient and sustainable tourism sector across the Mediterranean region. By integrating these strategies into the broader framework of climate resilience, the Mediterranean can set a precedent for adaptive and sustainable tourism practices that can be replicated in other vulnerable coastal regions worldwide.

## 5. Criteria Development for Climate Change Adaptation and Mitigation in Coastal Tourism

In light of the increasing climate vulnerabilities, particularly in the Mediterranean region, it is crucial to develop robust criteria for climate change adaptation and mitigation to ensure the sustainability of coastal tourism. This framework aims to guide tourism destinations in their efforts to adapt to and mitigate the impacts of climate change. By focusing on both the destination and regional levels, the criteria address the unique challenges faced by coastal tourism destinations while promoting cohesive regional strategies that enhance resilience and sustainability.

At the **destination level**, the criteria for adaptation emphasize localized strategies that ensure the immediate and long-term sustainability of tourism activities. One key concept is **environmental sustainability**, which involves monitoring and maintaining natural processes and incorporating measures that are flexible and reversible. This ensures that the natural environment, such as beaches and dunes, can continue to provide their protective and recreational functions despite changing climatic conditions. Another essential concept is **economic viability**, which focuses on implementing cost-effective adaptation strategies that can withstand and quickly recover from climate-related disruptions. This helps maintain the economic stability of the tourism sector, ensuring it remains a viable source of income for local communities.

**Socio-cultural integrity** is also a critical consideration, emphasizing the importance of engaging local communities in adaptation planning and implementation. By integrating the needs and knowledge of local populations, adaptation strategies become more culturally appropriate and likely to succeed. Raising awareness among both tourists and locals about climate risks and adaptation strategies through targeted education programs fosters a culture of resilience and proactive adaptation.

**Governance and policy support** are crucial for the successful implementation of adaptation measures. Integrating climate change adaptation into local urban planning and development regulations ensures that future developments are resilient to climate impacts. Additionally, enhancing community resilience through comprehensive disaster preparedness and response plans is vital for protecting both residents and tourists from climate-related hazards.

**Resilience building** is another key concept, promoting the construction of infrastructure that can be easily adapted or moved in response to changing environmental conditions. This flexibility allows destinations to respond dynamically to climate impacts, minimizing long-term risks and damages. Complementary measures, such as financial incentives and climate services, further support ongoing adaptation efforts and encourage proactive engagement from all stakeholders.

At the **regional level**, the criteria for mitigation focus on reducing greenhouse gas emissions and promoting sustainable practices across the Mediterranean coastal tourism sector. A primary concept is **greenhouse gas reduction**, which includes the adoption of renewable energy sources and the implementation of energy-saving technologies. These measures are essential for reducing the carbon footprint of tourism activities and enhancing overall energy efficiency.

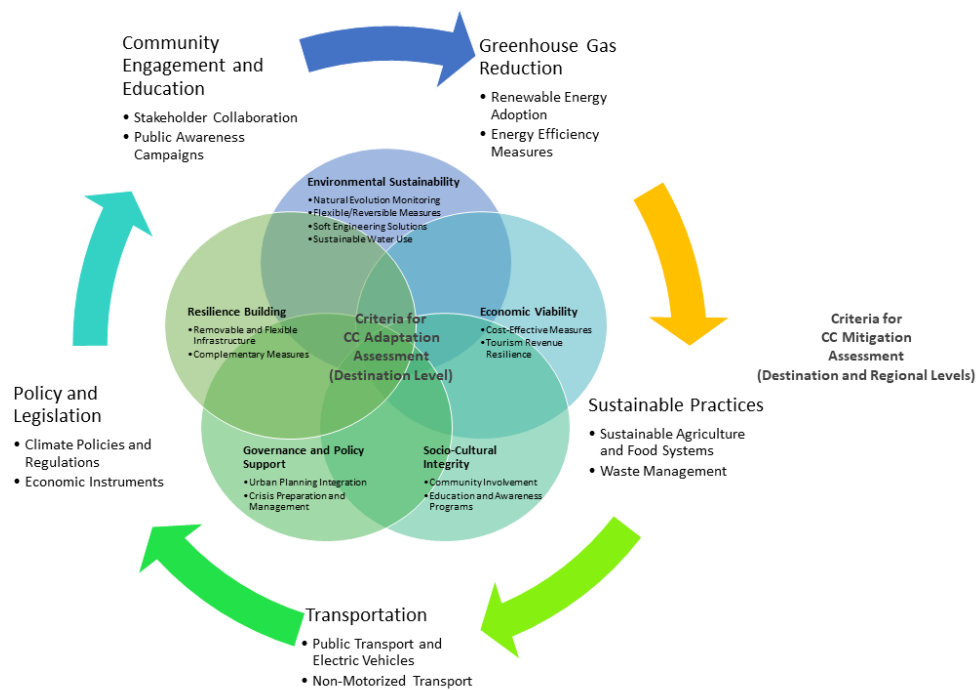
**Sustainable practices** are also emphasized, encouraging the reduction of emissions from various sectors, such as agriculture and waste management. Promoting local food sourcing and improving waste management practices help minimize environmental impacts while supporting local economies and sustainable food systems.

In terms of **transportation**, the criteria highlight the importance of promoting public transportation and the adoption of low-emission vehicles. Developing infrastructure for non-motorized transport, such as cycling and walking, further supports sustainable mobility and reduces the overall carbon footprint of tourism activities.

**Policy and legislation** play a critical role in driving mitigation efforts. Developing and enforcing policies that limit emissions and promote sustainable practices across the tourism sector are essential. Economic instruments, such as carbon pricing, taxes, and subsidies, incentivize emission reductions and encourage businesses to adopt sustainable practices.

Finally, **community engagement and education** are fundamental for the successful implementation of mitigation strategies. Fostering partnerships between local communities, governments, and tourism operators ensures collaborative efforts in reducing emissions and enhancing sustainability. Public awareness campaigns educate stakeholders about the importance of reducing greenhouse gas emissions and adopting sustainable practices, ensuring that everyone is informed and motivated to contribute to climate action.

Figure 2 Integration of Criteria for Climate Change Adaptation Assessment (Destination Level) and Climate Change Mitigation Assessment (Destination and Regional Levels)



Focusing on both the destination and regional levels for **mitigation** makes sense because effective mitigation often requires coordinated efforts across multiple jurisdictions and scales. **Greenhouse gas emissions** and their impacts are not confined to individual destinations; they have regional and global repercussions. Therefore, promoting renewable energy adoption, energy efficiency measures, and sustainable transportation requires a broader, cohesive strategy that can be implemented regionally while being adapted to local contexts. **Policy and legislation**, such as carbon pricing and emission regulations, are more effective when applied uniformly across a region, ensuring consistency and compliance. **Community engagement and education** at both levels foster a unified approach to sustainability, enabling the sharing of resources and best practices.

Focusing on **adaptation** at the destination level is essential because **adaptation measures** need to be highly specific to local environmental, social, and economic conditions. Coastal tourism destinations face unique and immediate impacts from climate change, such as sea-level rise, coastal erosion, and extreme weather events. These challenges require tailored solutions that address local vulnerabilities and leverage local strengths. **Environmental monitoring**, flexible infrastructure, and community involvement are best managed at the destination level, where detailed local knowledge and stakeholder engagement can drive effective and culturally appropriate adaptation measures.

### Complementary Nature of the Criteria

The criteria for adaptation and mitigation are complementary, addressing different but interconnected aspects of climate resilience. **Adaptation criteria** at the destination level focus on immediate, localized actions that enhance the capacity of specific tourism destinations to cope with and recover from climate impacts. These measures are crucial for maintaining the viability of tourism activities and protecting local communities and ecosystems.

On the other hand, **mitigation criteria** at both the destination and regional levels aim to reduce the broader, systemic drivers of climate change by lowering greenhouse gas emissions and promoting sustainable practices. Regional coordination ensures that mitigation efforts are scalable and impactful, addressing emissions that transcend local boundaries and require collective action.

Together, these criteria form a comprehensive approach to climate resilience, ensuring that Mediterranean coastal tourism can adapt to current and future climate impacts while contributing to global efforts to mitigate climate change. This integrated strategy supports sustainable development and the long-term health of coastal tourism economies and ecosystems.

## 5.1 Criteria Development for CC Adaptation Assessment (Destination Level)

The criteria for climate change adaptation at the destination level have been meticulously developed to address the unique challenges faced by coastal tourism destinations. These criteria encompass key areas such as environmental sustainability, economic viability, socio-cultural integrity, governance and policy support, resilience building, and sustainable water use. Derived from a thorough analysis of successful adaptation strategies and best practices globally and grounded in the comprehensive stakeholder survey, the proposed criteria provide a detailed framework to guide tourism operators, local governments, and communities in enhancing their adaptive capacities. By focusing on these critical areas, we aim to ensure that adaptation measures are practical, effective, and tailored to the specific needs and contexts of Mediterranean coastal destinations. The structured approach ensures that all aspects of adaptation, from environmental monitoring to community involvement and policy integration, are comprehensively addressed, providing a robust foundation for building resilience against climate impacts. This framework not only facilitates immediate adaptive actions but also supports long-term sustainability and resilience, ensuring the continued viability and attractiveness of coastal tourism in the face of changing climatic conditions.

### 1. Environmental Sustainability

#### *Natural Evolution Monitoring*

**Definition and Importance:** Implementing and maintaining surveillance networks to track physical processes and ecological changes is crucial for understanding and responding to the dynamic coastal environment. Continuous monitoring helps detect early signs of environmental stress, facilitating timely interventions.



**Key Components:**

- Establishing a network of sensors and observation points.
- Regularly collecting and analyzing data on coastal processes and ecological health.
- Integrating monitoring results into decision-making processes.

**Examples of Best Practices:**

- The Mediterranean Integrated Coastal Zone Management (ICZM) initiative includes extensive monitoring of coastal dynamics to guide sustainable development.

*Flexible/Reversible Measures*

**Definition and Importance:** Adaptation measures that can be easily reversed or adjusted without significant financial impact ensure that strategies remain effective as conditions change. This flexibility is crucial for managing uncertainty and reducing long-term risks.

**Key Components:**

- Designing infrastructure and policies that allow for adjustments.
- Regularly reviewing and updating measures based on new data and changing conditions.

**Examples of Best Practices:**

- Reversible land-use policies in the Netherlands that allow for temporary agricultural use of flood-prone areas.

*Soft Engineering Solutions*

**Definition and Importance:** Promoting beach nourishment and ecological engineering methods to stabilize beaches and dunes leverages natural processes to enhance coastal resilience. These methods are less intrusive and more sustainable compared to hard engineering solutions.

**Key Components:**

- Adding sand to eroding beaches to restore their profiles.
- Using vegetation and other natural materials to stabilize dunes and prevent erosion.

**Examples of Best Practices:**

- The beach nourishment programs in the Med region contribute to successfully restoring eroded beaches and improving coastal resilience.
- The use of marram grass planting on the Norfolk coast in the UK to stabilize dunes and protect against storm surges.

*Sustainable Water Use*

**Definition and Importance:** Implementing strategies for the efficient use and management of water resources is essential for sustaining tourism activities, especially in regions prone to water scarcity. Sustainable water use practices ensure that the demand for water does not exceed the supply, protecting both natural ecosystems and tourism operations.

**Key Components:**

- Tackling the balanced distribution (between activity sectors) of the water resources.
- Installing water-saving technologies such as low-flow fixtures and irrigation systems.
- Promoting the reuse of treated wastewater for landscaping and other non-potable uses.
- Implementing water conservation programs and incentives for reducing water use.

**Examples of Best Practices:**

- The use of greywater systems in hotels for irrigation purposes.

- Water conservation campaigns that encourage both tourists and residents to reduce water consumption.

## 2. Economic Viability

### *Cost-Effective Measures*

**Definition and Importance:** Prioritizing adaptation strategies that offer high impact with manageable costs ensures that resources are used efficiently. Cost-effective measures provide significant benefits without imposing excessive financial burdens on communities and businesses.

**Key Components:**

- Evaluating the cost-benefit ratio of different adaptation options.
- Implementing measures that provide immediate and long-term economic benefits.

**Examples of Best Practices:**

- The dune management program in the Netherlands, which uses cost-effective sand replenishment to maintain coastal defenses.

### *Tourism Revenue Resilience*

**Definition and Importance:** Ensuring tourism activities and infrastructure can withstand and quickly recover from climate-related disruptions is essential for maintaining the economic stability of tourism-dependent areas. Resilient tourism infrastructure supports continued visitor engagement and revenue generation.

**Key Components:**

- Designing and retrofitting infrastructure to be climate-resilient.
- Developing rapid response and recovery plans for tourism businesses.

**Examples of Best Practices:**

- The resilient design of the Maldives' tourism infrastructure, which includes elevated structures and flexible operations to handle extreme weather events.
- Crisis management plans in Phuket, Thailand, that ensure quick recovery of tourism services following natural disasters.

## 3. Socio-Cultural Integrity

### *Community Involvement*

**Definition and Importance:** Engaging local communities in adaptation planning and implementation ensures that their needs and knowledge are integrated into strategies. Community involvement fosters ownership and enhances the relevance and acceptance of adaptation measures.

**Key Components:**

- Including community representatives in planning and decision-making processes.
- Conducting regular consultations and feedback sessions with local residents.

**Examples of Best Practices:**

- A participatory coastal management approach in Bari, Italy, involves the local community in decision-making processes.
- Community-led dune restoration projects in the Region of Tuscany, Italy. The intervention involved planting 600 trees and 16,000 herbaceous and shrub plants, closing 130 paths on the dune, and opening 50 environmentally sustainable accesses.

### *Education and Awareness Programs*

**Definition and Importance:** Raising awareness among tourists and locals about climate risks and adaptation strategies through targeted campaigns fosters a culture of resilience and proactive adaptation. Education programs help stakeholders understand the importance of adaptation measures and how they can contribute.

**Key Components:**

- Developing and disseminating educational materials on climate risks and adaptation strategies.
- Organizing workshops, seminars, and awareness campaigns for different stakeholder groups.

**Examples of Best Practices:**

- The Mission for Natural Heritage releases an awareness campaign aiming to share knowledge about the causes and effects of coastal erosion, as well as solutions proposed or already put in place, engaging citizens from shore to shore all along the Mediterranean basin.
- The Caribbean Tourism Organization launched a Regional Tourism Education and Awareness Campaign to foster a discussion on climate resilience and sustainability on both the regional and international stage.

## 4. Governance and Policy Support

### *Urban Planning Integration*

**Definition and Importance:** Incorporating climate change adaptation considerations into local urban planning and development regulations ensures that future developments are resilient to climate impacts. Urban planning integration helps avoid maladaptation and promotes sustainable growth.

**Key Components:**

- Revising zoning laws and building codes to include climate resilience criteria.
- Ensuring new developments undergo climate impact assessments.

**Examples of Best Practices:**

- The climate-resilient urban planning framework in Rotterdam, which includes flood-proof building designs and green infrastructure.
- Barcelona's green urban planning initiatives, which incorporate climate adaptation measures into city development projects.

### *Crisis Preparation and Management*

**Definition and Importance:** Enhancing the resilience of communities through comprehensive disaster preparedness and response plans is vital for protecting both residents and tourists from climate-related hazards. Effective crisis management minimizes damage and speeds up recovery.

**Key Components:**

- Developing and regularly updating disaster response plans.
- Conducting drills and training programs for emergency response teams.

**Examples of Best Practices:**

- Portugal undertook an ambitious process to develop a new integrated wildland fire management plan with the goal of protecting Portugal from severe wildland fires.

- Spain has introduced the National Climate Change Adaptation Plan (PNACC) 2021-2030 – the basic planning instrument to promote coordinated action against the effects of climate change in Spain. Its main objective is to avoid or reduce present and future damage from climate change and to build a more resilient economy and society.

## 5. Resilience Building

### *Removable and Flexible Infrastructure*

**Definition and Importance:** Promoting the construction of buildings and facilities that can be easily moved or adapted in response to changing environmental conditions provides long-term resilience. Flexible infrastructure minimizes the risk of damage and reduces recovery costs.

**Key Components:**

- Designing modular and movable buildings.
- Implementing infrastructure that can be easily adapted or relocated as needed.

**Examples of Best Practices:**

- Floating houses in the Netherlands, designed to rise with water levels during floods.
- Artificial reefs, which can be set offshore or on the foreshore, reduce wave energy on the beaches behind them, slow down long-shore drift, favor foreshore growth to limit erosion, and function like submerged breakwaters, often made from materials such as geotextile, sand, large blocks, concrete, or pit run material.

### *Complementary Measures*

**Definition and Importance:** Implementing financial incentives, climate services, and information systems supports adaptation efforts and encourages proactive engagement from all stakeholders. These measures provide the necessary resources and information to facilitate effective adaptation.

**Key Components:**

- Offering subsidies and tax breaks for climate-resilient practices.
- Providing climate information services that offer real-time data and forecasts.

**Examples of Best Practices:**

- The use of climate information services helps stakeholders make informed decisions based on weather forecasts.
- Financial incentives for green building practices encourage sustainable construction and retrofitting.

## 5.2 Criteria Development for CC Mitigation Assessment (Destination and Regional Levels)

In developing the criteria for climate change mitigation assessment at both the destination and regional levels, we have structured the proposed criteria to address the key areas of greenhouse gas reduction, sustainable practices, transportation, policy and legislation, and community engagement and education. These criteria are derived from comprehensive analysis and best practices drawn from successful case studies worldwide, tailored specifically to the unique challenges and opportunities faced by coastal tourism destinations in the Mediterranean region, identified among others through a comprehensive stakeholder survey. By focusing on these critical areas, we aim to provide a robust and actionable framework that guides tourism operators, local governments, and communities in their efforts to reduce emissions and promote sustainability. The criteria are designed to be practical and flexible, ensuring they can be adapted to varying contexts and scales, from individual tourism destinations to broader regional

initiatives. This structured approach ensures a cohesive and comprehensive strategy for mitigating the impacts of climate change, enhancing the resilience and sustainability of Mediterranean coastal tourism.

## 1. Greenhouse Gas Reduction

### *Renewable Energy Adoption*

**Definition and Importance:** Promoting the use of solar, wind, and other renewable energy sources to reduce dependence on fossil fuels is critical for lowering greenhouse gas emissions. Transitioning to renewable energy helps mitigate climate change by reducing the carbon footprint of tourism operations.

**Key Components:**

- Installing solar panels and wind turbines in tourism facilities.
- Providing incentives for renewable energy projects.
- Integrating renewable energy systems into local and regional energy grids.

**Examples of Best Practices:**

- Increase the use of renewable energy sources such as solar, wind, and biomass to reduce dependence on fossil fuels and decrease CO<sub>2</sub> emissions in Sardinia, Italy.
- Wind farms in coastal Spain that supply renewable energy to nearby tourist destinations.

### *Energy Efficiency Measures*

**Definition and Importance:** Implementing energy-saving technologies and practices in buildings, transport, and tourism operations is essential for reducing energy consumption and greenhouse gas emissions. Enhanced energy efficiency contributes to both environmental sustainability and cost savings.

**Key Components:**

- Retrofitting buildings with energy-efficient lighting, heating, and cooling systems.
- Promoting the use of energy-efficient appliances and machinery.
- Implementing energy management systems to monitor and reduce consumption.

**Examples of Best Practices:**

- The Green Key certification program recognizes hotels and tourism facilities that implement energy-efficient practices.
- Upgrading to more energy-efficient lighting and HVAC systems (heating, ventilation, and air conditioning), implementing smart room technologies, and using renewable energy sources like solar panels in hotels can lead to cost savings in the long run and attract sustainability-conscious guests.

## 2. Sustainable Practices

### *Sustainable Agriculture and Food Systems*

**Definition and Importance:** Encouraging practices that reduce emissions from agricultural activities and promote local food sourcing help minimize the carbon footprint associated with food production and transportation. Sustainable agriculture supports local economies and enhances food security.

**Key Components:**

- Promoting organic farming and reduced use of chemical fertilizers.
- Encouraging local food sourcing and farm-to-table initiatives in tourism.
- Implementing practices that enhance soil health and carbon sequestration.

**Examples of Best Practices:**

- Farm-to-table programs that provide restaurants and hotels with fresh, locally sourced food.
- Organic farming initiatives reduce agricultural emissions and support local biodiversity and livelihoods.

### *Waste Management*

**Definition and Importance:** Improving waste management practices to minimize methane emissions and promote recycling and reduction of single-use plastics is vital for reducing the environmental impact of tourism activities. Effective waste management contributes to cleaner environments and lower greenhouse gas emissions.

**Key Components:**

- Implementing comprehensive recycling programs in tourism facilities.
- Reducing the use of single-use plastics through bans and alternatives.
- Managing organic waste through composting and anaerobic digestion.

**Examples of Best Practices:**

- Zero Waste initiatives that promote recycling and composting in hotels, restaurants, and tourist attractions.
- The elimination of single-use plastics in the hospitality industry by providing reusable alternatives.

## 3. Transportation

### *Public Transport and Electric Vehicles*

**Definition and Importance:** Encouraging the use of public transportation and the adoption of electric vehicles reduce emissions from tourism-related transport. Sustainable transportation options are crucial for lowering the carbon footprint of tourism activities.

**Key Components:**

- Expanding and improving public transportation networks.
- Providing incentives for the use of electric vehicles, including charging infrastructure.
- Promoting car-sharing programs and electric bike rentals.

**Examples of Best Practices:**

- The introduction of electric buses and trams to serve tourists and locals.
- The widespread availability of e-bike share systems supports sustainable mobility within the destinations.

### *Non-Motorized Transport*

**Definition and Importance:** Developing infrastructure to support cycling, walking, and other non-motorized modes of transport encourages low-emission travel and enhances the tourist experience. Non-motorized transport reduces traffic congestion and pollution while promoting health and well-being.

**Key Components:**

- Building and maintaining bike lanes and pedestrian pathways.
- Implementing bike-sharing programs and pedestrian-friendly zones.
- Promoting non-motorized transport through tourism marketing and incentives.

**Examples of Best Practices:**

- The extensive bike-sharing program in Paris, known as Vélib', which offers tourists an eco-friendly way to explore the city.
- The pedestrian-friendly zones and walking tours in historic cities like Florence, Italy, reduce vehicle traffic and emissions.

#### 4. Policy and Legislation

##### *Climate Policies and Regulations*

**Definition and Importance:** Developing and enforcing policies that limit emissions and promote sustainable practices across the tourism sector is essential for achieving long-term climate goals. Effective policies provide a regulatory framework that drives sustainable behaviour.

**Key Components:**

- Establishing emission reduction targets and standards for tourism businesses.
- Enforcing regulations that require energy efficiency and sustainable practices.
- Supporting policies that promote renewable energy and sustainable transport.

**Examples of Best Practices:**

- Encouraging hospitality businesses' certification aligned with GSTC criteria promotes the adoption of green practices.

##### *Economic Instruments*

**Definition and Importance:** Utilizing carbon pricing, taxes, and subsidies to incentivize emission reductions and sustainable practices aligns economic interests with environmental goals. Economic instruments make it financially attractive to adopt green practices.

**Key Components:**

- Implementing carbon pricing mechanisms, such as carbon taxes or cap-and-trade systems.
- Providing subsidies and tax incentives for renewable energy projects and energy-efficient upgrades.
- Offering grants and low-interest loans for sustainability initiatives in tourism.

**Examples of Best Practices:**

- The carbon taxes could encourage businesses, including tourism operators, to reduce their carbon emissions.
- Subsidies for solar energy installations could promote renewable energy use in the tourism sector.

#### 5. Community Engagement and Education

##### *Stakeholder Collaboration*

**Definition and Importance:** Fostering partnerships between local communities, governments, and tourism operators to support and implement mitigation strategies ensures a coordinated and inclusive approach. The collaboration leverages diverse expertise and resources for greater impact.

**Key Components:**

- Establishing multi-stakeholder committees and working groups.
- Facilitating regular meetings and communication channels for stakeholders.
- Sharing best practices and resources to support joint mitigation efforts.

**Examples of Best Practices:**

- The collaborative approach where stakeholders work together to protect the heritage from climate impacts.
- Community-based tourism initiatives where local communities participate in sustainable tourism planning and implementation.

### Public Awareness Campaigns

**Definition and Importance:** Conducting educational programs to raise awareness about the importance of reducing greenhouse gas emissions and adopting sustainable practices ensure that all stakeholders are informed and motivated to contribute to climate action. Awareness campaigns build a culture of sustainability.

#### Key Components:

- Developing and distributing educational materials on climate change and sustainability.
- Organizing workshops, seminars, and public events to engage and educate the community.
- Utilizing media and social platforms to reach a broader audience.

#### Examples of Best Practices:

- The "Leave No Trace" campaign in New Zealand, educating tourists on minimizing their environmental impact.
- Climate change education programs, such as "Eco-School" in Seychelles, inform tourists and locals about sustainable practices and resilience measures.

Figure 3 Challenges Associated with the Implementation of Climate Change Adaptation and Mitigation Criteria





### 5.3 Reflection on the Challenges Associated with the Implementation of Climate Change Adaptation and Mitigation Criteria

Developing standardized and harmonized criteria for assessing coastal tourism-related issues concerning climate change adaptation and mitigation is essential for guiding regions and destinations in the Mediterranean. These criteria, designed to be applicable at both the regional and destination levels through a bottom-up approach, aim to foster comprehensive and cohesive climate strategies and plans. They set the stage for:

1. **Activity 1.5 - Approach for Drafting Regional and Destination Tourism Climate Strategies and Plans**
  - **Objective:** To design methods to draft Regional and Destination (focus on adaptation) Strategies and Plans.
2. **Activity 1.6 - Approach for Defining the Enabling Conditions for Tourism Climate Action in Regions**
  - **Objective:** To define a framework to establish the policy and governance enabling conditions for climate action in tourism at the regional level.

However, implementing these criteria presents several challenges that need to be addressed to ensure their effectiveness and sustainability.

#### Coordination and Consistency Across Levels

One of the primary challenges is ensuring coordination and consistency in the application of criteria across different levels. The criteria must be adaptable to specific local contexts while maintaining a unified approach that aligns with regional strategies. This requires effective communication and collaboration between local and regional stakeholders, which can be difficult due to varying priorities, resources, and levels of capacity.

#### Challenges:

- Harmonizing diverse local needs (related to specific challenges) with regional objectives.
- Ensuring consistent application and monitoring of criteria.
- Facilitating effective communication between local and regional authorities.

#### Relevance to Activities 1.5 and 1.6:

- Ensuring coordination and consistency is crucial for drafting cohesive Regional and Destination Tourism Climate Strategies (Activity 1.5).
- Effective communication and collaboration underpin the establishment of enabling policy and governance conditions (Activity 1.6).

#### Strategies and Recommendations:

- **Establish Multi-Stakeholder Platforms:** Create forums where local and regional stakeholders can regularly meet to discuss and align their strategies.
- **Develop Clear Communication Protocols:** Implement standardized communication methods to ensure all parties are well-informed and aligned.
- **Foster Regional Support Systems:** Encourage the formation of support systems where more developed regions assist less developed ones in implementing criteria.

## Resource Allocation and Financial Constraints

Implementing the criteria necessitates significant resources, including funding, technology, and human capacity. Coastal tourism destinations, particularly those in developing regions, may face financial constraints that limit their ability to adopt and implement the recommended measures. Securing sustainable funding and resource allocation is crucial for the success of these initiatives.

### Challenges:

- Limited financial resources for comprehensive implementation and monitoring.
- High costs associated with advanced technologies and infrastructure investments and improvements.
- Unequal distribution of resources across different destinations.

### Relevance to Activities 1.5 and 1.6:

- Adequate funding is essential for drafting and implementing robust climate strategies (Activity 1.5).
- Identifying financial mechanisms and resources is a key aspect of establishing enabling conditions for climate action (Activity 1.6).

### Strategies and Recommendations:

- **Explore Diverse Funding Sources:** Look into public-private partnerships, international aid, and climate finance mechanisms.
- **Implement Cost-Sharing Models:** Develop frameworks where costs are shared among stakeholders to reduce the burden on individual entities.
- **Ensure Equitable Resource Distribution:** Create policies that ensure resources are distributed based on need and potential impact.

## Capacity Building and Knowledge Gaps

Effective implementation requires that local authorities, tourism operators, and communities have the necessary knowledge and skills. Capacity building is essential to empower stakeholders to adopt and maintain adaptation and mitigation measures. However, there are often significant knowledge gaps and a lack of technical expertise, which can hinder progress.

### Challenges:

- Insufficient training and educational programs.
- Limited technical expertise and access to best practices.
- Need for continuous capacity-building initiatives.

### Relevance to Activities 1.5 and 1.6:

- Building local capacity and addressing knowledge gaps are critical for drafting effective climate strategies (Activity 1.5).
- Continuous capacity-building initiatives support the establishment of robust policy and governance frameworks (Activity 1.6).

### Strategies and Recommendations:

- **Implement Comprehensive Training Programs:** Develop and conduct training programs tailored to the needs of different stakeholders.
- **Facilitate Knowledge Sharing:** Create platforms for sharing best practices and success stories.
- **Promote Continuous Learning:** Encourage ongoing education and training to keep stakeholders updated on the latest developments and techniques.

### Community Engagement and Socio-Cultural Factors

Engaging local communities and integrating their knowledge and needs into the adaptation and mitigation strategies is critical. However, socio-cultural factors, such as differing perceptions of climate change, resistance to change, and varying levels of awareness, can pose significant challenges.

#### Challenges:

- Varying levels of community awareness and engagement.
- Resistance to change due to cultural or economic reasons.
- Ensuring inclusive participation from all community members.

#### Relevance to Activities 1.5 and 1.6:

- Effective community engagement is essential for drafting inclusive and accepted climate strategies (Activity 1.5).
- Overcoming socio-cultural barriers is vital for creating enabling conditions for climate action (Activity 1.6).

#### Strategies and Recommendations:

- **Develop Targeted Awareness Campaigns:** Create campaigns that address specific concerns and values of different community segments.
- **Facilitate Inclusive Engagement:** Ensure all community members, including marginalized groups, are involved in the planning process.
- **Address Resistance to Change:** Use educational programs to demonstrate the long-term benefits of adaptation and mitigation efforts.

### Policy and Governance Enabling Conditions

Creating the policy and governance enabling conditions for climate action in tourism requires a robust framework that supports the implementation of criteria. This includes developing supportive policies, regulations, and governance structures. However, political and bureaucratic hurdles, as well as varying governance capacities, can impede progress.

#### Challenges:

- Navigating complex political and bureaucratic environments.
- Aligning local policies with regional and national frameworks.
- Ensuring transparency and accountability in governance.

#### Relevance to Activities 1.5 and 1.6:

- Establishing clear policy and governance frameworks is critical for both drafting strategies (Activity 1.5) and defining enabling conditions (Activity 1.6).

### Strategies and Recommendations:

- **Advocate for Supportive Policies:** Work with policymakers to create regulations that support climate adaptation and mitigation efforts.
- **Streamline Governance Processes:** Simplify bureaucratic procedures to facilitate easier implementation of climate strategies.
- **Ensure Transparency and Accountability:** Develop mechanisms for tracking and reporting progress to maintain accountability.

### Monitoring and Evaluation

Regular monitoring and evaluation are essential to assess the effectiveness of the implemented measures and make necessary adjustments. Developing robust monitoring systems and indicators that can track progress at both the regional and destination levels is challenging but critical for continuous improvement.

### Challenges:

- Developing and maintaining effective monitoring systems.
- Collecting and sharing reliable and consistent data.
- Ensuring adaptive management practices based on evaluation results.

### Relevance to Activities 1.5 and 1.6:

- Effective monitoring and evaluation systems are necessary for assessing the success of climate strategies (Activity 1.5).
- Continuous improvement based on monitoring results supports the sustainability of enabling conditions (Activity 1.6).

### Strategies and Recommendations:

- **Develop Robust Monitoring Systems:** Create comprehensive systems with clear indicators for tracking progress.
- **Leverage Technology for Data Collection:** Use modern technologies to gather and analyze data efficiently.
- **Promote Adaptive Management:** Encourage flexibility in strategies to allow for adjustments based on evaluation outcomes.

## 6. Recommendations

### 6.1 Summary of Recommendations

The development of comprehensive and adaptable criteria for assessing climate change adaptation and mitigation in coastal tourism is essential to address the unique challenges faced by Mediterranean destinations. These criteria aim to guide targeted assessments and strategies at both regional and destination levels, ensuring practical and effective measures are implemented to enhance resilience and sustainability. The recommendations are derived from thorough analyses and stakeholder engagements and are structured to support the design and implementation of robust climate action plans.

#### **For Climate Change Adaptation at the Destination Level:**

1. **Environmental Sustainability:** Prioritize monitoring and managing natural evolution, implementing flexible and reversible measures, and promoting soft engineering solutions to stabilize coastal ecosystems.
2. **Economic Viability:** Focus on cost-effective adaptation measures and ensure tourism revenue resilience through climate-resilient infrastructure and rapid recovery plans.
3. **Socio-Cultural Integrity:** Engage local communities in adaptation planning, enhance public education and awareness, and integrate community knowledge into adaptation strategies.
4. **Governance and Policy Support:** Incorporate climate change considerations into tourism development and spatial planning, enhance crisis preparation and management, and develop supportive policies and regulations.
5. **Resilience Building:** Promote removable and flexible infrastructure and implement complementary measures such as financial incentives and climate services.
6. **Sustainable Water Use:** Implement strategies for efficient water management, including water-saving technologies, wastewater reuse, and conservation programs.

#### **For Climate Change Mitigation at the Destination and Regional Levels:**

1. **Greenhouse Gas Reduction:** Encourage renewable energy adoption and energy efficiency measures across tourism operations.
2. **Sustainable Practices:** Implement sustainable agriculture and food systems, and improve waste management practices to reduce emissions.
3. **Transportation:** Promote public transport, electric vehicles, and non-motorized transport options to reduce tourism-related emissions.
4. **Policy and Legislation:** Develop and enforce climate policies and economic instruments to incentivize sustainable practices and emission reductions.
5. **Community Engagement and Education:** Foster stakeholder collaboration and conduct public awareness campaigns to support and implement mitigation strategies.

### 6.2 Implementation Strategy

A strategic and phased approach is essential to effectively implement the proposed criteria for climate change adaptation and mitigation in coastal tourism destinations. This approach ensures that the criteria are integrated into regional and destination-level planning and operations in a systematic and sustainable

manner. The strategy is divided into three key phases: Establish Foundations, Integrate and Execute, and Monitor and Refine. Each phase focuses on specific actions that collectively contribute to the successful implementation of the criteria, addressing the diverse challenges and opportunities identified in the earlier sections of this report.

### **Phase 1: Establish Foundations**

**Engaging a broad range of stakeholders**, including local communities, tourism operators, governments, and NGOs, is essential to ensure that the criteria reflect diverse needs and perspectives. This engagement fosters a sense of ownership and commitment among stakeholders, making it more likely that they will actively participate in and support the implementation of climate strategies. The involvement of these diverse groups ensures that the strategies developed are comprehensive and consider various viewpoints and requirements. **Building capacity** through comprehensive training programs is another critical component of this phase. These programs are designed to enhance local capacities and bridge knowledge gaps related to climate adaptation and mitigation. By equipping stakeholders with the necessary skills and knowledge, we can ensure that they are well-prepared to implement and sustain the proposed measures. Training should cover best practices, new technologies, and practical implementation strategies to ensure that all participants are capable of contributing effectively to climate action initiatives. **Securing funding** is also a vital part of establishing a solid foundation for climate action. Exploring and securing diverse funding sources, such as public-private partnerships, international aid, and climate finance mechanisms, is crucial for supporting the implementation of the proposed measures. Adequate funding ensures that resources are available to carry out the necessary actions, from infrastructure development to community programs and beyond.

These criteria are the cornerstone of future strategic plans and actions for climate change-resilient tourism planning. They provide a structured and practical framework that guides the development and implementation of effective climate strategies. By laying a strong foundation in this initial phase, we set the stage for ongoing, sustainable climate action that can adapt and evolve in response to new challenges and opportunities.

### **Phase 2: Integrate and Execute**

In the second phase, the focus shifts to integrating the criteria into local and regional policies and executing practical measures. Advocating for **incorporating climate adaptation and mitigation considerations into planning and development policies** ensures that these aspects are systematically addressed. Promoting the construction of **resilient and flexible infrastructure** that can adapt to changing environmental conditions is vital for long-term sustainability. Furthermore, launching targeted **awareness campaigns and inclusive engagement strategies** helps to foster community buy-in and active participation in climate action.

### **Phase 3: Monitor and Refine**

The final phase emphasizes the importance of **monitoring** and **continuous improvement**. Developing robust monitoring and evaluation frameworks with clear indicators is necessary to track the effectiveness of implemented measures and ensure ongoing progress. Using feedback from these monitoring activities to refine and adjust strategies ensures that they remain relevant and effective in the face of evolving climate impacts. This iterative process allows for the adaptation and enhancement of strategies over time, fostering resilience and sustainability in coastal tourism destinations.

### 6.3 Monitoring and Evaluation

Effective monitoring and evaluation (M&E) are crucial to ensure the successful implementation and continuous improvement of climate adaptation and mitigation strategies in coastal tourism destinations. M&E provides the necessary insights to track progress, assess the effectiveness of implemented measures, and make informed adjustments to strategies over time. A comprehensive M&E framework is essential for maintaining accountability, transparency, and adaptability in climate action efforts. This section outlines the key steps involved in establishing a robust M&E framework that supports the goals of the proposed criteria.

To begin with, it is important to **establish clear indicators**. These indicators should be specific, measurable, achievable, relevant, and time-bound (SMART) to effectively assess the progress and effectiveness of each criterion. Developing SMART indicators allows for precise tracking and evaluation, ensuring that goals are met and any deviations are promptly addressed. It should be noted that the final output of Activity 1.4 includes the proposal of indicators to monitor the climate change adaptation in coastal destinations as described in the Task description.

Next, leveraging **advanced technologies** such as remote sensing, GIS, and climate modeling can significantly enhance the data collection and analysis process. These technologies provide accurate and timely information on environmental changes, infrastructure resilience, and community engagement, enabling a more comprehensive understanding of the impacts and effectiveness of the adaptation and mitigation strategies.

**Regular reporting** mechanisms are essential for maintaining transparency and accountability. By implementing consistent reporting schedules, progress can be tracked, and findings shared with stakeholders, fostering a culture of openness and continuous improvement. Regular reports also serve as a valuable tool for communicating successes and challenges and facilitating stakeholder engagement and support.

Creating **feedback loops** is another critical component of the M&E framework. Feedback loops ensure that lessons learned and stakeholder inputs are systematically incorporated into the ongoing refinement and adjustment of strategies. This iterative process allows for the dynamic adaptation of measures, ensuring that they remain effective and relevant in the face of evolving climate conditions and emerging challenges.

Lastly, **capacity building** in M&E is fundamental to ensure sustained and effective tracking of climate action efforts. Continuous training and development programs for local authorities, tourism operators, and community members enhance their ability to implement and maintain M&E activities. Building local capacities ensures that M&E efforts are not only sustainable but also embedded within the local context, enhancing their relevance and impact.

### 6.4 Relating the Criteria to Activities 1.5 and 1.6

#### **Activity 1.5: Approach for Drafting Regional and Destination Tourism Climate Strategies and Plans**

- **Objective:** To design methods to draft Regional and Destination (focus on adaptation) Strategies and Plans.
- **Outputs:** D1.5.1 & D1.5.2: Technical report and brief for Regions & destinations describing the methods and how to apply them to develop the Regional & Destination Tourism Climate Strategy/Plan.

The criteria developed for climate change adaptation at the destination level serve as an essential tool for Activity 1.5. They provide a comprehensive framework for creating detailed, context-specific adaptation strategies. These criteria ensure that the strategies are practical, effective, and tailored to each destination's unique challenges, thereby facilitating the development of robust and resilient tourism climate plans.

The criteria guide the strategy development process by outlining essential components such as environmental sustainability, economic viability, socio-cultural integrity, governance and policy support, and resilience building. This holistic approach ensures that all critical aspects of adaptation are considered, promoting a balanced and thorough strategy. The criteria help craft ambitious plans that are feasible within the destination's financial and logistical constraints by emphasizing practical and flexible measures. For example, focusing on cost-effective strategies and reversible adaptation actions ensures that resources are used efficiently while maintaining the ability to adjust strategies as needed.

These criteria are designed to be adaptable, allowing each destination to tailor the framework to its specific local conditions. This flexibility ensures that the strategies developed are relevant and effective for the particular challenges and opportunities the destination faces. The criteria also stress the importance of engaging local communities and integrating their knowledge and needs into the planning process. This engagement fosters ownership and support for the adaptation measures, which is crucial for their long-term success. Education and awareness programs are also emphasized, ensuring that all stakeholders understand the importance of adaptation and how they can contribute. Incorporating governance and policy support into the criteria ensures the strategies align with local and regional regulatory frameworks. This alignment facilitates smoother implementation and integration into existing planning processes, enhancing the overall effectiveness of the adaptation efforts.

By using these criteria, regions and destinations can develop climate adaptation strategies that are comprehensive, practical, and tailored to their unique needs, promoting long-term sustainability and resilience in coastal tourism.

#### **Activity 1.6: Approach for Defining the Enabling Conditions for Tourism Climate Action in Regions**

- **Objective:** To define a framework to establish the policy and governance enabling conditions for climate action in tourism at the regional level.
- **Outputs:** D1.6.1: Technical report and brief describing the identified enabling conditions, with a checklist for supporting regions.

The criteria for climate change mitigation at both the destination and regional levels provide a foundational basis for Activity 1.6 by highlighting the importance of comprehensive policy and governance frameworks. These criteria emphasize the development of supportive policies, economic instruments, and collaborative approaches that create an enabling environment for effective climate action.

The criteria guide the establishment of policy frameworks by emphasizing the need to develop and enforce climate policies and regulations that limit emissions and promote sustainable practices. This ensures that regions have a clear regulatory structure to guide and support climate action efforts. Economic instruments such as carbon pricing, taxes, and subsidies are highlighted as crucial tools for incentivizing emission reductions and sustainable practices. These instruments align economic interests with environmental goals, motivating both businesses and consumers to adopt greener practices.

Fostering partnerships between local communities, governments, and tourism operators is also emphasized. This collaborative approach ensures that climate action is coordinated and benefits from all



stakeholders' combined efforts and resources. By promoting stakeholder collaboration, the criteria help create a unified and effective climate action strategy. The criteria also underscore the importance of infrastructure and technology in supporting climate action. Promoting the adoption of renewable energy, energy efficiency measures, and sustainable transportation solutions ensures that regions have the necessary tools and technologies to reduce their carbon footprint effectively. Finally, monitoring and evaluation are critical components of the criteria, emphasizing establishing clear indicators and leveraging advanced technologies for data collection and analysis. This robust M&E framework ensures that progress is tracked, transparency is maintained, and strategies are continually refined based on feedback and evolving conditions.

By integrating these criteria into Activity 1.6, regions can establish the enabling conditions necessary for effective and sustained climate action in the tourism sector. This comprehensive approach ensures that the necessary policies, economic incentives, collaborative frameworks, and monitoring systems are in place to support significant climate mitigation outcomes across various destinations.

## 7. Conclusion

### *Summary of Key Points*

The report provides a comprehensive framework for developing criteria to assess climate change adaptation and mitigation in coastal tourism destinations in the Mediterranean. The Mediterranean region is highly vulnerable to climate change, which impacts its rich biodiversity, cultural heritage, and coastal tourism. The report aims to develop criteria focusing on environmental sustainability, economic viability, socio-cultural integrity, governance, and resilience building.

A multi-step methodology was employed, involving a review of existing frameworks and best practices, stakeholder identification and engagement, needs assessment and gap analysis, development of draft criteria, and stakeholder validation and refinement. Stakeholder engagement was crucial in ensuring the criteria reflected diverse perspectives and practical insights.

The review of existing frameworks and best practices included a detailed analysis of adaptation and mitigation frameworks, guidelines, projects, and case studies from within and outside the Mediterranean region. Insights were synthesized to develop robust criteria for climate change adaptation and mitigation. Findings from stakeholder engagement highlighted key challenges and barriers, including financial constraints, insufficient data, limited stakeholder engagement, and inadequate policy frameworks. Opportunities identified include promoting eco-tourism, adopting renewable energy, implementing nature-based solutions, and enhancing community engagement.

The criteria development process resulted in adaptation criteria for the destination level, focusing on environmental sustainability, economic viability, socio-cultural integrity, governance, and resilience building. Mitigation criteria for both regional and destination levels emphasize greenhouse gas reduction, sustainable practices, transportation, policy and legislation, and community engagement and education. The report also reflects on the challenges associated with implementing these criteria. Consolidated recommendations for climate change adaptation and mitigation in coastal tourism destinations were provided, along with implementation strategies and approaches for monitoring and evaluation to ensure the effectiveness of the criteria.

### *Final Thoughts*

The development of comprehensive criteria for climate change adaptation and mitigation is crucial for enhancing the resilience of coastal tourism destinations in the Mediterranean. These criteria provide a structured approach to evaluate current practices, identify areas for improvement, and support the formulation of robust, evidence-based climate action plans tailored to the unique needs of these destinations.

By addressing key dimensions such as environmental sustainability, economic viability, socio-cultural integrity, governance, and resilience building, the criteria aim to balance the complex interplay between preserving natural resources and promoting economic development. The engagement of stakeholders throughout the process ensures that the criteria are practical, inclusive, and grounded in real-world experiences.

The successful implementation of these criteria can significantly enhance the resilience of coastal tourism destinations to climate change impacts. This will not only safeguard the region's rich biodiversity and cultural heritage but also support sustainable economic growth and improve the well-being of local communities. Ultimately, the developed criteria have the potential to serve as a model for other regions facing similar challenges, contributing to global efforts in combating climate change and promoting sustainable tourism practices.

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## External Experts to Prereview the Criteria Proposed

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Emmanuel Salim is an Assistant Professor of Geography at the University of Toulouse Jean Jaurès and an Associate Researcher at the Institute of Geography and Sustainability at the University of Lausanne. His scientific interests include geographical information systems (GIS), spatial analysis, and the impacts of climate change on urban and rural environments.

### **Lucas Berard-Chenu**

Lucas Berard-Chenu is a post-doctoral fellow in the ASTREE team of the INRAE Laboratory of Mountain Ecosystems and Societies. His research focuses on the interrelationships between climate change and ski tourism. Additionally, he teaches geography at the Institut d’Urbanisme et de Géographie Alpine in Grenoble and is an active member of the Perce-Neige collective of young researchers working on mountain issues.

### **Anna Spenceley**

Dr. Anna Spenceley is a tourism consultant with over 20 years of international experience. She is a renowned expert in sustainable and responsible tourism, focusing on biodiversity conservation, protected areas, transfrontier conservation areas, certification, indicators, concessions, public-private partnerships, triple bottom line assessments (economic, social, and environmental), value and supply chains, small enterprise development, and poverty reduction. Her extensive publication record and diverse project experience highlight her significant contributions to the field.



## Indicator Proposal for Climate Change Adaptation

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# Executive Summary

## Brief Overview of the Report

This report presents a comprehensive framework for monitoring and evaluating climate change adaptation in the Mediterranean tourism sector. It aims to provide a set of practical, measurable indicators tailored to the unique challenges faced by coastal tourism destinations in this region. The report is grounded in a thorough review of academic literature, stakeholder engagement, and alignment with established climate adaptation frameworks such as the CLIMATE-ADAPT platform.

## Key Objectives

The primary objectives of this report are:

- **Develop Comprehensive Indicators:** Establish a set of indicators covering critical dimensions such as environmental sustainability, economic viability, sociocultural integrity, governance, and resilience building.
- **Facilitate Targeted Assessments:** Enable targeted assessments that guide effective mitigation and adaptation strategies tailored to the unique needs of Mediterranean coastal tourism destinations.
- **Support Decision-Makers:** Provide actionable information and best practices to decision-makers and local communities, enhancing the resilience of tourism destinations to climate change impacts.
- **Promote Sustainable Development:** Encourage the adoption of sustainable tourism practices that balance environmental protection with economic and social development in the Mediterranean region.

## Main Findings and Recommendations

The report's main findings underscore the necessity for robust monitoring and evaluation (M&E) systems that can track climate change impacts on tourism effectively. The curated set of indicators, drawn from extensive literature review and stakeholder consultations, addresses this need comprehensively.

### Key Findings:

- **Physical and Environmental Indicators:** Changes in annual temperature, number of hot days, sea-level rise, extreme precipitation days, and fire weather index are crucial for assessing the direct impacts of climate change on tourism infrastructure and activities.
- **Economic Indicators:** Variability in tourism revenue, costs of climate adaptation, and changes in insurance premiums reflect the economic resilience of the tourism sector.
- **Sociocultural Indicators:** Tourist satisfaction, local community attitudes, and public awareness campaigns on water efficiency highlight the sociocultural dimensions of climate adaptation.
- **Governance and Policy Indicators:** The existence and implementation of climate adaptation policies, funding for adaptation projects, and stakeholder involvement are vital for ensuring effective governance and policy support.
- **Biodiversity and Ecosystem Health Indicators:** Changes in species distribution, habitat loss and degradation, water quality, and the extent of protected areas are essential for maintaining ecosystem health and biodiversity, which are critical for nature-based tourism.

### Recommendations:

- **Implementation and Monitoring:** Establish a dedicated institutional framework to oversee the implementation and monitoring of the indicators. Invest in capacity-building programs for stakeholders and secure adequate funding and resources for monitoring systems.

- **Continuous Monitoring and Periodic Reviews:** Implement continuous monitoring systems for real-time data collection and conduct periodic reviews to assess the effectiveness of the monitoring system, identify gaps, and make necessary adjustments.
- **Stakeholder Engagement and Integration with Policy:** Maintain ongoing engagement with stakeholders and ensure that the indicators and monitoring systems are aligned with national and regional climate adaptation policies and tourism strategies. Advocate for climate resilience in tourism through public awareness campaigns and policy dialogues.
- **International Collaboration:** Foster collaboration with international organizations and initiatives to share best practices, access funding, and enhance the overall effectiveness of climate adaptation efforts in the tourism sector.

In summary, the proposed indicators and recommendations provide a robust framework for enhancing the resilience of Mediterranean coastal tourism to climate change. By implementing these strategies, stakeholders can ensure sustainable development and long-term viability of tourism destinations in the face of evolving climate challenges.



## 1. Introduction

The Mediterranean region is globally recognized for its rich biodiversity, cultural heritage, and stunning coastlines, which have made it a premier destination for tourism. However, this popularity brings significant challenges, particularly as the region faces increasing vulnerability to the adverse effects of climate change. Coastal tourism, heavily dependent on stable and predictable weather patterns, is particularly susceptible to these changes. Key climate-related challenges include rising sea levels, more frequent extreme weather events, coastal erosion, and biodiversity loss. These factors threaten the sustainability of Mediterranean coastal tourism, which is a critical component of the region's economy and environmental health.

In response to these challenges, the Interreg Euro-Med NaTour4CChange project has been initiated. This project, spanning from 2024 to 2026, aims to enhance the resilience of coastal destinations in the Mediterranean through comprehensive climate action plans and strategies. A crucial part of this initiative involves the development of a survey to identify and assess best practices in climate action for coastal tourism destinations.

The primary goal of this report is to develop a set of practical, measurable indicators for climate change adaptation specifically tailored for the tourism sector. These indicators will enable the monitoring of adaptation efforts over time and across different geographical locations, ultimately aiding in filling existing knowledge gaps and guiding effective adaptation strategies. This report is structured to provide a comprehensive overview of the current landscape of climate change adaptation indicators and to propose a refined set of indicators tailored for the tourism sector.

The report will focus on several key objectives:

1. **Develop Comprehensive Indicators:** Establish a set of indicators covering critical dimensions such as environmental sustainability, economic viability, socio-cultural integrity, governance, and resilience building.
2. **Facilitate Targeted Assessments:** Enable targeted assessments that guide effective mitigation and adaptation strategies tailored to the unique needs of Mediterranean coastal tourism destinations.
3. **Support Decision-Makers:** Provide actionable information and best practices to decision-makers and local communities, enhancing the resilience of tourism destinations to climate change impacts.
4. **Promote Sustainable Development:** Encourage the adoption of sustainable tourism practices that balance environmental protection with economic and social development in the Mediterranean region.

By achieving these objectives, the report aims to support the development and implementation of robust climate action plans, contributing to the long-term sustainability and resilience of coastal tourism destinations in the Mediterranean.

## 2. Methodology

This section outlines the methodology employed to develop a set of practical, measurable indicators for climate change adaptation specifically tailored for the tourism sector. The methodology involves a multi-step approach, including a systematic literature review, stakeholder engagement, alignment with the CLIMATE-ADAPT platform, refinement and selection of indicators, and data collection methods.

### 2.1 Systematic Literature Review

A thorough review of academic literature, policy documents, and existing frameworks was conducted to compile a comprehensive list of indicators used in climate change adaptation, with a specific focus on those relevant to the tourism sector.

**Purpose:** The aim of this review was to establish a solid knowledge baseline by identifying the most effective and widely used indicators in climate change adaptation. This process involved:

- Identifying key academic papers, policy reports, and existing adaptation frameworks.
- Extracting relevant indicators and assessing their applicability to the tourism sector.
- Analyzing the strengths and limitations of each indicator to determine their relevance and effectiveness.

The literature review provided a comprehensive understanding of the current landscape of adaptation indicators, informing the subsequent steps of the methodology.

### 2.2 Engagement with Project Partners

Analysis of Deliverable 3: Report on questionnaire responses and stakeholder consultations to understand their needs, capacities, and preferences regarding climate change adaptation monitoring.

**Purpose:** The goal was to ensure that the indicators are aligned with the project objectives, feasible for implementation by all partners, and capable of addressing the specific challenges and opportunities identified in the project regions and destinations. This process ensured that the indicators developed were practical, contextually relevant, and relevant to the stakeholders.

### 2.3 Alignment with CLIMATE-ADAPT

Cross-referenced the identified indicators with those listed on the CLIMATE-ADAPT platform, prioritizing indicators that are already recognized and recommended at the European level.

**Purpose:** To leverage existing, validated indicators with broader acceptance and support, ensuring consistency and comparability of adaptation efforts. This alignment involved:

- Reviewing the CLIMATE-ADAPT platform to identify relevant indicators.
- Comparing these indicators with those identified through the literature review and stakeholder engagement.
- Selecting indicators that align with European-level standards and recommendations.

Aligning with CLIMATE-ADAPT ensures that the proposed indicators are robust, credible, and in line with broader regional adaptation efforts.

## 2.4 Indicator Refinement and Selection Process

Refined the list of indicators based on feedback from project partners and practical considerations of data availability and monitoring capabilities.

**Purpose:** To finalize a set of actionable indicators tailored to the specific needs and contexts of the tourism sector's adaptation to climate change. The process included:

- Developing an initial draft of indicators based on insights from the literature review, stakeholder engagement, and CLIMATE-ADAPT alignment.
- Conducting iterative rounds of refinement to ensure the indicators are comprehensive, feasible, and aligned with project goals.
- Evaluating the practicality of each indicator in terms of data availability, ease of monitoring, and relevance to the tourism sector.

This refinement process ensured that the final set of indicators was well-rounded, practical, and tailored to the specific needs of Mediterranean coastal tourism destinations.

## 2.5 Data Sources and Collection Methods

Collected data from both primary and secondary sources to support the development and validation of the indicators.

**Purpose:** To ensure a robust and evidence-based approach to indicator development. Data collection involved:

- **Primary Sources:** Conducting interviews and distributing questionnaires to stakeholders, including policymakers, tourism operators, and community representatives. This provided firsthand insights and qualitative data on current adaptation practices and challenges.
- **Secondary Sources:** Review existing reports, policy documents, academic studies, and frameworks related to climate change adaptation in the tourism sector. This provided a comprehensive overview of proven practices and existing indicators.

The combination of primary and secondary data sources ensured a well-rounded and thoroughly informed development process for the climate change adaptation indicators.

By following this structured methodology, we ensured that the developed indicators are robust, evidence-based, and aligned with the needs and realities of Mediterranean coastal tourism destinations facing the impacts of climate change.

### 3. Systematic Literature Review

Effective monitoring and evaluation are crucial for the successful implementation of climate change adaptation strategies, particularly in the tourism sector. Monitoring provides the necessary data to assess progress, identify areas needing improvement, and ensure accountability among stakeholders. The purpose of developing practical, measurable indicators is to enable consistent tracking of adaptation efforts, facilitating informed decision-making and guiding effective strategies. These indicators serve as benchmarks for evaluating the impact of adaptation measures, helping to fill existing knowledge gaps and promote resilience in coastal tourism destinations. By establishing a robust framework of indicators, we can better understand the effectiveness of adaptation initiatives, support policy development, and foster sustainable practices within the tourism industry.

#### 3.1 Introduction to Different Approaches and Experiences in Designing and Implementing M&E Systems for Adaptation

Monitoring and evaluation (M&E) systems are pivotal in understanding and enhancing the effectiveness of climate change adaptation efforts. These systems, particularly at aggregated levels such as national or regional scales, face unique challenges and opportunities. The document by Hammill et al. (2014)<sup>1</sup> provides an in-depth analysis of various national M&E systems, offering valuable lessons on the design and implementation of these frameworks.

##### Lessons Learned from Designing and Implementing M&E Systems

- 1. Conceptual Clarity and Flexibility:** One of the primary challenges is the ambiguity around what constitutes successful adaptation. Different stakeholders may have varying interpretations, such as vulnerability reduction, resilience building, or risk management. Clear definitions and conceptual frameworks are crucial but often lacking. Flexibility in M&E design allows stakeholders to experiment and adapt systems as understanding evolves.
- 2. Integration with Existing Systems:** Aligning new M&E systems with existing structures can save resources and facilitate smoother implementation. For instance, France and Kenya integrated their adaptation M&E into existing sectoral and national systems, respectively. This approach helps in utilizing existing data and structures, reducing redundancy and fostering coherence.
- 3. Multi-Stakeholder Participation:** Engaging a broad range of stakeholders is essential for the successful design and implementation of M&E systems. This includes consultations with government agencies, local communities, and experts from various fields. Stakeholder involvement not only ensures that the M&E system addresses diverse needs but also builds ownership and support for its implementation. For example, Germany and Morocco involved stakeholders from different sectors in selecting appropriate indicators.
- 4. Resource and Capacity Building:** Establishing effective M&E systems requires significant resources and capacity building. This includes financial, human, and technical resources. Countries like Kenya have developed detailed processes and infrastructure for data management,

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<sup>1</sup> Hammill, A., Dekens, J., Leiter, T., Olivier, J., Klockemann, L., & Stock, E. (2014). *Repository of adaptation indicators: Real case examples from national monitoring and evaluation systems*. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). Available at <https://www.iisd.org/publications/report/repository-adaptation-indicators-real-case-examples-national-monitoring-and>

while others, like Nepal, have focused on capacity building at both national and local levels. Continuous investment in capacity building is crucial for the sustainability of M&E systems.

**5. Incremental and Iterative Approach:** Adopting an incremental approach can be beneficial, especially when resources are limited. Starting with pilot projects or focusing on specific sectors can help in gradually building a comprehensive M&E system. Morocco's approach of piloting M&E systems in certain regions before scaling up is an example of this strategy. This allows for learning and adjustments based on initial experiences.

**6. Data and Information Management:** High-quality data is the cornerstone of effective M&E systems. Identifying and managing relevant data can be challenging, particularly in developing countries where data may be scattered, inconsistent, or of variable quality. Systems like Germany and the UK have processes for narrowing down ideal indicators based on available datasets. Ensuring the reliability and accessibility of data is critical for credible M&E.

**7. Emphasis on Learning:** Recognizing that adaptation is an ongoing process, several M&E systems emphasize learning as a core objective. Regular reviews, stock-taking reports, and knowledge-sharing platforms are integral components of these systems. Norway's system, which focuses on learning through regular stakeholder interactions, exemplifies this approach. This helps in understanding evolving conditions and improving adaptation strategies over time.

**8. Political Will and Leadership:** Strong political commitment and leadership are essential for the establishment and sustainability of M&E systems. Policy mandates and directives provide the necessary impetus for mobilizing resources and engaging stakeholders. Examples from Germany and Kenya highlight the importance of political support in driving the M&E process and ensuring its integration into national strategies.

**Informing the Development of the Current Report:** The lessons learned from the comparative analysis of national M&E systems for climate change adaptation are instrumental in guiding the development of the current report. By understanding the importance of conceptual clarity, integration with existing systems, stakeholder engagement, and resource allocation, we can ensure that the proposed indicators for the tourism sector are robust and actionable. The emphasis on iterative learning and political support further informs our approach, highlighting the need for continuous improvement and strong leadership in implementing the M&E framework. This report will draw on these insights to develop a tailored set of indicators that are feasible, effective, and aligned with the specific needs of Mediterranean coastal tourism destinations, ultimately enhancing their resilience to climate change.

### 3.1.1 In-depth Analysis of Relevant Indicators and Their Applicability to the Tourism Sector

*Extracting Relevant Indicators: Hammill et al. (2014)*

The document "Repository of Adaptation Indicators" by Hammill et al. (2014a)<sup>2</sup> offers a comprehensive set of indicators derived from national M&E systems. These indicators span various sectors and provide insights into their application contexts, making them valuable for designing M&E systems in the tourism

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<sup>2</sup> Hammill, A., Dekens, J., Leiter, T., Olivier, J., Klockemann, L., Stock, E., & Gläser, A. (2014). *Repository of adaptation indicators: Real case examples from national monitoring and evaluation systems*. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). <https://www.adaptationcommunity.net/download/me/me-guides-manuals-reports/giz2014-en-climate-adaptation-indicator-repository.pdf>

sector. Below are some key indicators extracted for their relevance to tourism and climate change adaptation:

1. **Climate Parameters:**

- **Change in Annual Temperature:** Degree Celsius. This indicator is crucial for tourism as temperature changes can affect tourist seasonality and comfort.
- **Number of Hot Days:** Days/year. Relevant for assessing the frequency of heatwaves which can impact outdoor tourism activities and tourist health.

2. **Climate Impacts:**

- **Number of Properties Flooded Per Year:** Number. Essential for understanding the impact of flooding on tourism infrastructure and accommodations.
- **Number of People Living in Flood-Prone Areas:** Number. Important for assessing the risk to tourists and local communities in popular coastal destinations.

3. **Adaptation Action:**

- **Number of Public Awareness Campaigns on Water Efficiency:** Number. Relevant for promoting sustainable water use practices among tourists and tourism businesses.
- **Degree of Integration of Climate Change into Development Planning:** Scale of integration. Crucial for ensuring that tourism development considers climate adaptation measures.

4. **Adaptation Results:**

- **Percentage of Urban Households with Access to Piped Water:** Percentage. Ensures that tourist facilities and local populations have reliable water sources, critical during droughts.
- **Reduction of Flood Damage and Disaster Relief Costs in Cities:** Monetary value. Measures the effectiveness of flood protection measures in tourist areas.

[Analyzing the Strengths and Limitations of Each Indicator](#)

1. **Change in Annual Temperature**

- **Strengths:** Provides a direct measure of climate change impacts; easy to communicate.
- **Limitations:** Requires long-term data series (at least 30 years); may not capture localized microclimates affecting tourism hotspots.
- **Relevance to Tourism:** Directly impacts tourist comfort and seasonality; useful for long-term planning of tourism activities and infrastructure.

2. **Number of Hot Days**

- **Strengths:** Indicates stress levels on tourists and tourism infrastructure during heatwaves.
- **Limitations:** Requires long-term data series; regional variations may affect applicability.
- **Relevance to Tourism:** Critical for health and safety planning, especially for outdoor and summer tourism.

### 3. Number of Properties Flooded Per Year

- **Strengths:** Provides concrete data on flood impacts; useful for risk assessment.
- **Limitations:** Attribution to climate change may be challenging; other factors like urban planning can influence flooding.
- **Relevance to Tourism:** Essential for insurance assessments and infrastructure resilience planning in flood-prone tourist areas.

### 4. Number of People Living in Flood-Prone Areas

- **Strengths:** Highlights exposure and potential risk areas; useful for emergency planning.
- **Limitations:** Does not account for adaptive measures in place; socio-economic factors influencing vulnerability are not considered.
- **Relevance to Tourism:** Important for ensuring tourist safety and planning evacuation or adaptation measures.

### 5. Number of Public Awareness Campaigns on Water Efficiency

- **Strengths:** Encourages sustainable practices; easy to implement and track.
- **Limitations:** Effectiveness depends on campaign quality and reach; does not measure actual water savings.
- **Relevance to Tourism:** Promotes sustainable tourism practices; helps mitigate water scarcity impacts in tourist destinations.

### 6. Degree of Integration of Climate Change into Development Planning

- **Strengths:** Ensures holistic approach to climate adaptation; promotes long-term resilience.
- **Limitations:** Difficult to measure accurately; subjective assessment of integration quality.
- **Relevance to Tourism:** Essential for sustainable tourism development; ensures new projects are climate-resilient.

### 7. Percentage of Urban Households with Access to Piped Water

- **Strengths:** Directly measures water accessibility; critical for health and hygiene.
- **Limitations:** May not capture water quality issues; urban focus may overlook rural tourist areas.
- **Relevance to Tourism:** Ensures reliable water supply for tourists; critical during peak seasons and droughts.

### 8. Reduction of Flood Damage and Disaster Relief Costs in Cities

- **Strengths:** Quantifies economic benefits of adaptation measures; encourages investment in resilience.
- **Limitations:** Requires comprehensive economic data; may be influenced by non-climatic factors.

- **Relevance to Tourism:** Demonstrates the financial viability of adaptation investments; crucial for policy advocacy and funding.

#### *Extracting Relevant Indicators: Forster et al., (2024)*

The document "Indicators of Global Climate Change 2023" by Forster et al. (2024)<sup>3</sup> provides a comprehensive analysis of various climate indicators. Several of these indicators are particularly relevant to the tourism sector, especially in coastal areas vulnerable to climate change. Here, we extract and assess the applicability of these indicators to the tourism sector, along with their strengths and limitations.

Below are some key indicators extracted for their relevance to tourism and climate change adaptation:

#### **Climate Parameters:**

1. **Annual Temperature Anomalies:** Degree Celsius. This indicator measures deviations from the long-term average temperature and is crucial for tourism as it affects seasonality and comfort levels.
2. **Sea Surface Temperature Anomalies:** Degree Celsius. Relevant for assessing changes in marine environments that impact marine tourism activities like diving and snorkeling.
3. **Temperature Change Over Protected Areas:** Degree Celsius. Impacts biodiversity and the attractiveness of natural tourist destinations.
4. **Phenology Shifts:** Timing of seasonal biological events. Affects the timing of natural events that attract tourists, such as flowering seasons and animal migrations.

#### **Climate Impacts:**

1. **Global Mean Sea Level Rise:** Millimeters per year. Essential for understanding the threat to coastal infrastructure and accommodations due to rising sea levels.
2. **Frequency of Extreme Weather Events:** Number of events per year. Important for assessing the risk of weather-related disruptions to tourism activities and infrastructure.
3. **Coastal Erosion Rates:** Rate of shoreline retreat (meters per year). Directly affects beach tourism and coastal infrastructure.
4. **Vegetation Greenness Index (NDVI):** Index value. Reflects the health and attractiveness of natural landscapes.

#### **Adaptation Action:**

1. **Number of Coral Bleaching Events:** Number per year. Relevant for monitoring the health of coral reefs, which are critical attractions for marine tourism.

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<sup>3</sup> Forster, P. M., Smith, C., Walsh, T., Lamb, W. F., Lamboll, R., Hall, B., Hauser, M., Ribes, A., Rosen, D., Gillett, N. P., Palmer, M. D., Rogelj, J., von Schuckmann, K., Trewin, B., Allen, M., Andrew, R., Betts, R. A., Borger, A., Boyer, T., ... & Zhai, P. (2024). Indicators of Global Climate Change 2023: Annual update of key indicators of the state of the climate system and human influence. *Earth System Science Data*, 16(2625-2658). <https://doi.org/10.5194/essd-16-2625-2024>



2. **Investment in Sustainable Tourism Infrastructure:** Monetary value. Crucial for ensuring that tourism development projects incorporate climate adaptation measures.
3. **Implementation of Sustainable Tourism Practices:** Number of tourism businesses adopting sustainable practices. Promotes resilience and sustainability in the tourism sector.
4. **Installation of Early Warning Systems:** Number of systems installed. Enhances safety for tourists in areas prone to extreme weather events.

#### **Adaptation Results:**

1. **Tourism Revenue Variability:** Percentage change. Measures the economic impact of climate variability on tourism revenue, indicating the sector's resilience.
2. **Reduction in Flood Damage and Disaster Relief Costs:** Monetary value. Measures the effectiveness of flood protection and adaptation measures in reducing economic losses in tourist areas.
3. **Bird Population Indices:** Population index (relative to baseline year). Birds are key attractions for wildlife tourism and indicators of ecosystem health.
4. **Area of Land Under Conservation Agreements:** Area (hectares). Ensures the protection and sustainable use of natural areas.

#### Analyzing the Strengths and Limitations of Each Indicator

##### 1. **Annual Temperature Anomalies**

- **Strengths:** Provides a direct measure of climate change impacts; widely monitored and reported.
- **Limitations:** Requires long-term data series to establish trends; regional variations may not be captured fully.
- **Relevance to Tourism:** Directly impacts tourist comfort and seasonality; useful for long-term planning of tourism activities and infrastructure.

##### 2. **Sea Surface Temperature Anomalies**

- **Strengths:** Directly impacts marine tourism activities such as diving, snorkeling, and fishing.
- **Limitations:** Requires extensive and accurate oceanographic data; regional disparities in data collection might affect accuracy.
- **Relevance to Tourism:** Changes in sea surface temperatures can influence marine biodiversity, which is crucial for marine and coastal tourism activities.

##### 3. **Temperature Change Over Protected Areas**

- **Strengths:** Provides direct data on climate impacts; crucial for biodiversity and eco-tourism.
- **Limitations:** Requires long-term and localized temperature data; regional differences may complicate analysis.

- **Relevance to Tourism:** Impacts biodiversity and the attractiveness of natural tourist destinations.
- **Measure:** Average temperature change over protected areas compared to historical data.

#### 4. Phenology Shifts

- **Strengths:** Indicates ecological responses to climate change; important for seasonal tourism planning.
- **Limitations:** Requires extensive ecological monitoring; influenced by multiple environmental factors.
- **Relevance to Tourism:** Affects the timing of natural events that attract tourists, such as flowering seasons and animal migrations.
- **Measure:** Changes in the timing of key biological events (e.g., flowering dates, migration timings).

#### 5. Global Mean Sea Level Rise

- **Strengths:** Provides a clear indication of long-term changes in sea levels; essential for coastal planning and infrastructure development.
- **Limitations:** Attribution to specific local impacts can be complex; the rate of change might vary significantly across different regions.
- **Relevance to Tourism:** Rising sea levels threaten coastal infrastructure, beaches, and resorts, necessitating adaptation strategies to protect these assets.

#### 6. Frequency of Extreme Weather Events

- **Strengths:** Measures the increasing occurrence of extreme weather, providing critical data for disaster risk management and planning.
- **Limitations:** Extreme weather events are influenced by various factors, making it difficult to attribute changes solely to climate change.
- **Relevance to Tourism:** Extreme weather events can disrupt tourism activities, damage infrastructure, and reduce destination attractiveness.

#### 7. Coastal Erosion Rates

- **Strengths:** Provides concrete data on physical changes to coastal areas; important for risk assessment.
- **Limitations:** Requires consistent and long-term monitoring; influenced by multiple factors.
- **Relevance to Tourism:** Directly affects beach tourism and coastal infrastructure.
- **Measure:** Annual rate of shoreline retreat in meters per year.

#### 8. Vegetation Greenness Index (NDVI)

- **Strengths:** Widely used and understood; provides a clear visual indicator of vegetation health.

- **Limitations:** Can be influenced by factors other than climate change (e.g., land use changes).
- **Relevance to Tourism:** Reflects the health and attractiveness of natural landscapes.
- **Measure:** Normalized Difference Vegetation Index (NDVI) values over time for key tourist areas.

#### 9. Number of Coral Bleaching Events

- **Strengths:** Provides specific insights into the health of coral reefs, a key resource for marine tourism.
- **Limitations:** Requires detailed and frequent monitoring to capture bleaching events accurately.
- **Relevance to Tourism:** Coral bleaching affects the biodiversity and visual appeal of reefs, directly impacting marine tourism experiences.

#### 10. Investment in Sustainable Tourism Infrastructure

- **Strengths:** Reflects the level of preparedness and proactive measures taken by tourism destinations, indicating long-term resilience.
- **Limitations:** Measuring the effectiveness of these investments can be challenging; data availability may vary.
- **Relevance to Tourism:** Investments in sustainable infrastructure can mitigate the impacts of climate change and enhance the sustainability of tourism destinations.

#### 11. Implementation of Sustainable Tourism Practices

- **Strengths:** Encourages best practices; can be tracked over time to measure progress.
- **Limitations:** Effectiveness depends on widespread adoption; difficult to enforce and monitor.
- **Relevance to Tourism:** Promotes resilience and sustainability; essential for long-term viability of tourism destinations.
- **Measure:** Percentage of tourism businesses in a region that have implemented recognized sustainable practices (e.g., water conservation, energy efficiency).

#### 12. Installation of Early Warning Systems

- **Strengths:** Provides a clear measure of preparedness; crucial for tourist safety.
- **Limitations:** Effectiveness depends on system coverage and functionality; requires regular updates.
- **Relevance to Tourism:** Enhances safety for tourists in areas prone to extreme weather events.
- **Measure:** Number of early warning systems installed and operational in tourist areas.

#### 13. Tourism Revenue Variability

- **Strengths:** Directly links climate impacts with economic outcomes in the tourism sector, helping to assess economic resilience.
- **Limitations:** Influenced by multiple factors beyond climate change, such as economic conditions and geopolitical events.
- **Relevance to Tourism:** Variability in revenue can indicate how well tourism destinations are adapting to climate changes and their economic resilience.

#### 14. Reduction in Flood Damage and Disaster Relief Costs

- **Strengths:** Quantifies economic benefits of adaptation measures; encourages investment in resilience.
- **Limitations:** Requires comprehensive economic data; may be influenced by non-climatic factors.
- **Relevance to Tourism:** Demonstrates the financial viability of adaptation investments; crucial for policy advocacy and funding.

#### 15. Bird Population Indices

- **Strengths:** Widely monitored and understood; indicates broader ecological health.
- **Limitations:** Influenced by various factors beyond climate change.
- **Relevance to Tourism:** Birds are key attractions for wildlife tourism and indicators of ecosystem health.
- **Measure:** Annual population index for different bird classes.

#### 16. Area of Land Under Conservation Agreements

- **Strengths:** Directly links conservation efforts to land management practices.
- **Limitations:** The effectiveness depends on the enforcement and management of agreements.
- **Relevance to Tourism:** Ensures the protection and sustainable use of natural areas.
- **Measure:** Total area of land under conservation agreements in hectares.

*Extracting Relevant Indicators: SIDA - The Swedish International Development Cooperation Agency (2011)*

The document "Environmental and Climate Change Indicators" by SIDA - The Swedish International Development Cooperation Agency (2011)<sup>4</sup> provides a comprehensive repository of such indicators, which are pivotal for various sectors, including tourism.

Below are some key indicators extracted for their relevance to tourism and climate change adaptation:

#### **Climate Parameters:**

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<sup>4</sup> SIDA - The Swedish International Development Cooperation Agency. (2011). *Environmental and climate change indicators*. Available at <https://www.sida.se/en/sidas-international-work/thematic-areas/environment-and-climate>

1. **Change in Annual Temperature:** Degree Celsius. This indicator measures deviations from the long-term average temperature and is crucial for tourism as it affects seasonality and comfort levels.
2. **Number of Hot Days:** Days/year. Relevant for assessing the frequency of heatwaves which can impact outdoor tourism activities and tourist health.

#### **Climate Impacts:**

1. **Number of Properties Flooded Per Year:** Number. Essential for understanding the impact of flooding on tourism infrastructure and accommodations.
2. **Number of People Living in Flood-Prone Areas:** Number. Important for assessing the risk to tourists and local communities in popular coastal destinations.

#### **Adaptation Action:**

1. **Number of Public Awareness Campaigns on Water Efficiency:** Number. Relevant for promoting sustainable water use practices among tourists and tourism businesses.
2. **Degree of Integration of Climate Change into Development Planning:** Scale of integration. Crucial for ensuring that tourism development considers climate adaptation measures.

#### **Adaptation Results:**

1. **Percentage of Urban Households with Access to Piped Water:** Percentage. Ensures that tourist facilities and local populations have reliable water sources, critical during droughts.
2. **Reduction of Flood Damage and Disaster Relief Costs in Cities:** Monetary value. Measures the effectiveness of flood protection measures in tourist areas.

#### **Analyzing the Strengths and Limitations of Each Indicator**

1. **Change in Annual Temperature**
  - **Strengths:** Provides a direct measure of climate change impacts; widely monitored and reported.
  - **Limitations:** Requires long-term data series to establish trends; regional variations may not be captured fully.
  - **Relevance to Tourism:** Directly impacts tourist comfort and seasonality; useful for long-term planning of tourism activities and infrastructure.
2. **Number of Hot Days**
  - **Strengths:** Indicates stress levels on tourists and tourism infrastructure during heatwaves.
  - **Limitations:** Requires long-term data series; regional variations may affect applicability.
  - **Relevance to Tourism:** Critical for health and safety planning, especially for outdoor and summer tourism.
3. **Number of Properties Flooded Per Year**
  - **Strengths:** Provides concrete data on flood impacts; useful for risk assessment.

- **Limitations:** Attribution to climate change may be challenging; other factors like urban planning can influence flooding.
  - **Relevance to Tourism:** Essential for insurance assessments and infrastructure resilience planning in flood-prone tourist areas.
4. **Number of People Living in Flood-Prone Areas**
- **Strengths:** Highlights exposure and potential risk areas; useful for emergency planning.
  - **Limitations:** Does not account for adaptive measures in place; socio-economic factors influencing vulnerability are not considered.
  - **Relevance to Tourism:** Important for ensuring tourist safety and planning evacuation or adaptation measures.
5. **Number of Public Awareness Campaigns on Water Efficiency**
- **Strengths:** Encourages sustainable practices; easy to implement and track.
  - **Limitations:** Effectiveness depends on campaign quality and reach; does not measure actual water savings.
  - **Relevance to Tourism:** Promotes sustainable tourism practices; helps mitigate water scarcity impacts in tourist destinations.
6. **Degree of Integration of Climate Change into Development Planning**
- **Strengths:** Ensures holistic approach to climate adaptation; promotes long-term resilience.
  - **Limitations:** Difficult to measure accurately; subjective assessment of integration quality.
  - **Relevance to Tourism:** Essential for sustainable tourism development; ensures new projects are climate-resilient.
7. **Percentage of Urban Households with Access to Piped Water**
- **Strengths:** Directly measures water accessibility; critical for health and hygiene.
  - **Limitations:** May not capture water quality issues; urban focus may overlook rural tourist areas.
  - **Relevance to Tourism:** Ensures reliable water supply for tourists; critical during peak seasons and droughts.
8. **Reduction of Flood Damage and Disaster Relief Costs in Cities**
- **Strengths:** Quantifies economic benefits of adaptation measures; encourages investment in resilience.
  - **Limitations:** Requires comprehensive economic data; may be influenced by non-climatic factors.
  - **Relevance to Tourism:** Demonstrates the financial viability of adaptation investments; crucial for policy advocacy and funding.

### *Extracting Relevant Indicators: Stevens et al. (2023)*

The 2023 National Climate Assessment (NCA)<sup>5</sup> provides a comprehensive set of climate change indicators used to monitor and evaluate the impacts of climate change across various sectors. These indicators are crucial for understanding how climate change affects the tourism industry and for guiding effective adaptation strategies. Below are some key indicators extracted for their relevance to tourism and climate change adaptation:

#### **Climate Parameters:**

1. **Change in Annual Temperature:** Degree Celsius. This indicator measures deviations from the long-term average temperature and is crucial for tourism as it affects seasonality and comfort levels.
2. **Number of Hot Days:** Days/year. Relevant for assessing the frequency of heatwaves, which can impact outdoor tourism activities and tourist health.

#### **Climate Impacts:**

1. **Frequency of Extreme Weather Events:** Number of events per year. Essential for understanding the risk of weather-related disruptions to tourism activities and infrastructure.
2. **Sea Level Rise:** Millimeters per year. Important for assessing the threat to coastal tourism infrastructure and accommodations.

#### **Adaptation Action:**

1. **Number of Public Awareness Campaigns on Climate Risks:** Number. Relevant for promoting sustainable practices and preparedness among tourists and tourism businesses.
2. **Investment in Climate-Resilient Tourism Infrastructure:** Monetary value. Crucial for ensuring that tourism development projects incorporate climate adaptation measures.

#### **Adaptation Results:**

1. **Tourism Revenue Variability:** Percentage change. Measures the economic impact of climate variability on tourism revenue, indicating the sector's resilience.
2. **Reduction in Disaster Relief Costs:** Monetary value. Measures the effectiveness of adaptation measures in reducing economic losses in tourist areas.

### *Analyzing the Strengths and Limitations of Each Indicator*

#### **1. Change in Annual Temperature**

- **Strengths:** Provides a direct measure of climate change impacts; widely monitored and reported.

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<sup>5</sup> Stevens, L. E., Kolian, M., Arndt, D., Blunden, J., Johnson, E. W., Liu, A. Y., & Spiegel, S. (2023). Appendix 4. Indicators. In A. R. Crimmins, C. W. Avery, D. R. Easterling, K. E. Kunkel, B. C. Stewart, & T. K. Maycock (Eds.), *Fifth National Climate Assessment*. U.S. Global Change Research Program, Washington, DC, USA. <https://doi.org/10.7930/NCA5.2023.A4>

- **Limitations:** Requires long-term data series to establish trends; regional variations may not be fully captured.
- **Relevance to Tourism:** Directly impacts tourist comfort and seasonality; useful for long-term planning of tourism activities and infrastructure.

## 2. Number of Hot Days

- **Strengths:** Indicates stress levels on tourists and tourism infrastructure during heatwaves.
- **Limitations:** Requires long-term data series; regional variations may affect applicability.
- **Relevance to Tourism:** Critical for health and safety planning, especially for outdoor and summer tourism.

## 3. Frequency of Extreme Weather Events

- **Strengths:** Measures the increasing occurrence of extreme weather, providing critical data for disaster risk management and planning.
- **Limitations:** Extreme weather events are influenced by various factors, making it difficult to attribute changes solely to climate change.
- **Relevance to Tourism:** Extreme weather events can disrupt tourism activities, damage infrastructure, and reduce destination attractiveness.

## 4. Sea Level Rise

- **Strengths:** Provides a clear indication of long-term changes in sea levels; essential for coastal planning and infrastructure development.
- **Limitations:** Attribution to specific local impacts can be complex; the rate of change might vary significantly across different regions.
- **Relevance to Tourism:** Rising sea levels threaten coastal infrastructure, beaches, and resorts, necessitating adaptation strategies to protect these assets.

## 5. Number of Public Awareness Campaigns on Climate Risks

- **Strengths:** Encourages sustainable practices and preparedness; easy to implement and track.
- **Limitations:** Effectiveness depends on campaign quality and reach; does not measure actual preparedness.
- **Relevance to Tourism:** Promotes sustainable tourism practices; helps mitigate the impacts of climate change on tourism.

## 6. Investment in Climate-Resilient Tourism Infrastructure

- **Strengths:** Reflects the level of preparedness and proactive measures taken by tourism destinations, indicating long-term resilience.
- **Limitations:** Measuring the effectiveness of these investments can be challenging; data availability may vary.



- **Relevance to Tourism:** Investments in sustainable infrastructure can mitigate the impacts of climate change and enhance the sustainability of tourism destinations.

#### 7. Tourism Revenue Variability

- **Strengths:** Directly links climate impacts with economic outcomes in the tourism sector, helping to assess economic resilience.
- **Limitations:** Influenced by multiple factors beyond climate change, such as economic conditions and geopolitical events.
- **Relevance to Tourism:** Variability in revenue can indicate how well tourism destinations are adapting to climate changes and their economic resilience.

#### 8. Reduction in Disaster Relief Costs

- **Strengths:** Quantifies economic benefits of adaptation measures; encourages investment in resilience.
- **Limitations:** Requires comprehensive economic data; may be influenced by non-climatic factors.
- **Relevance to Tourism:** Demonstrates the financial viability of adaptation investments; crucial for policy advocacy and funding.

*Extracting Relevant Indicators: Arnott et al., (2016) & Forster et al. (2024)*

This analysis explores climate change adaptation indicators from two key documents: Arnott et al. (2016)<sup>6</sup>, which reviews diverse indicators across different contexts, and Forster et al. (2024)<sup>7</sup>, which provides global climate indicators essential for understanding broad climate trends. By assessing the strengths, limitations, and applicability of these indicators, we aim to determine their relevance and effectiveness for the tourism sector.

#### **Document 1: Arnott et al. (2016) - Evaluation that counts: A review of climate change adaptation indicators & metrics**

##### **Relevant CC Adaptation Indicators:**

1. **Coastal Resilience Index:** Provides community leaders with methods to predict community resilience levels.
2. **ND-GAIN Index:** Helps prioritize investments for efficient responses to climate challenges.

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<sup>6</sup> Arnott, J. C., Moser, S. C., & Goodrich, K. A. (2016). Evaluation that counts: A review of climate change adaptation indicators & metrics using lessons from effective evaluation and science-practice interaction. *Environmental Science & Policy*. <https://doi.org/10.1016/j.envsci.2016.06.017>

<sup>7</sup> Forster, P. M., Smith, C., Walsh, T., Lamb, W. F., Lamboll, R., Hall, B., Hauser, M., Ribes, A., Rosen, D., Gillett, N. P., Palmer, M. D., Rogelj, J., von Schuckmann, K., Trewin, B., Allen, M., Andrew, R., Betts, R. A., Borger, A., Boyer, T., & Zhai, P. (2024). Indicators of Global Climate Change 2023: Annual update of key indicators of the state of the climate system and human influence. *Earth System Science Data*, 16(2625-2658). <https://doi.org/10.5194/essd-16-2625-2024>

3. **A Climate Adaptation Plan for the Red Lake Band of Chippewa Indians:** Accompanies action items with success indicators.
4. **Indicators of Urban Climate Resilience:** Assesses improvement qualitatively and quantitatively.

#### **Strengths:**

- **Coastal Resilience Index:**
  - Simple and inexpensive method for community leaders. Helps prioritize resource allocation based on resilience levels.
- **ND-GAIN Index:**
  - Comprehensive, combining academic and practical insights. Aims to assist both public and private sectors in prioritizing investments.
- **A Climate Adaptation Plan for the Red Lake Band of Chippewa Indians:**
  - Culturally sensitive and context-specific. Developed with stakeholder engagement, ensuring relevance.
- **Indicators of Urban Climate Resilience:**
  - Engages multiple stakeholders in developing a comprehensive set of indicators. Provides a holistic approach to urban climate resilience.

#### **Limitations:**

- **Coastal Resilience Index:**
  - Limited to coastal communities. May not be comprehensive enough for all adaptation needs.
- **ND-GAIN Index:**
  - Requires significant data and resources to maintain. May not fully capture local nuances due to its broad scope.
- **A Climate Adaptation Plan for the Red Lake Band of Chippewa Indians:**
  - Specific to the Chippewa community; may not be generalizable. Dependent on the community's capacity to implement the indicators.
- **Indicators of Urban Climate Resilience:**
  - May be resource-intensive to implement. Requires ongoing stakeholder engagement and data collection.

#### **Applicability to Tourism Sector:**

- **Coastal Resilience Index:**
  - Directly applicable to coastal tourism destinations. Can help prioritize infrastructure investments to protect tourism assets.
- **ND-GAIN Index:**

- Useful for tourism operators to assess broader regional risks and resilience. Can guide investments in resilient tourism infrastructure.
- **A Climate Adaptation Plan for the Red Lake Band of Chippewa Indians:**
  - Not directly applicable to tourism but provides insights into community-specific adaptation.
- **Indicators of Urban Climate Resilience:**
  - Applicable to urban tourism destinations. Helps in developing resilient tourism strategies within cities.

## Document 2: Forster et al. (2024) - Indicators of Global Climate Change 2023

### Relevant CC Adaptation Indicators:

1. **Global Surface Temperature:** Tracks changes in global temperatures.
2. **Greenhouse Gas Concentrations:** Measures levels of key greenhouse gases.
3. **Sea Level Rise:** Monitors changes in global sea levels.
4. **Extreme Weather Events:** Records occurrences and impacts of extreme weather.

### Strengths:

- **Global Surface Temperature:**
  - Provides a clear indicator of global warming trends. Widely recognized and scientifically robust.
- **Greenhouse Gas Concentrations:**
  - Directly linked to climate change causes. Essential for tracking mitigation efforts.
- **Sea Level Rise:**
  - Crucial for coastal and island regions. Direct impact on coastal infrastructure and ecosystems.
- **Extreme Weather Events:**
  - Reflects the increasing frequency and intensity of climate impacts. Important for disaster preparedness and response planning.

### Limitations:

- **Global Surface Temperature:**
  - Broad indicator, not specific to adaptation outcomes. Requires long-term data for meaningful analysis.
- **Greenhouse Gas Concentrations:**
  - Focuses more on mitigation than adaptation. Does not directly measure adaptation progress.
- **Sea Level Rise:**

- Requires significant investment in monitoring infrastructure. May not capture localized adaptation efforts.
- **Extreme Weather Events:**
  - Difficult to attribute single events directly to climate change. Requires comprehensive data collection and analysis.

#### **Applicability to Tourism Sector:**

- **Global Surface Temperature:**
  - Useful for long-term planning in tourism regions sensitive to temperature changes.
- **Greenhouse Gas Concentrations:**
  - Can guide sustainable tourism practices and carbon offset programs.
- **Sea Level Rise:**
  - Critical for coastal and island tourism destinations. Helps in planning for infrastructure protection and relocation.
- **Extreme Weather Events:**
  - Essential for disaster risk management in tourism operations. Informs emergency preparedness and response strategies.

**Arnott et al. (2016)** provides indicators that are context-specific and developed with stakeholder engagement, making them highly relevant for specific communities or sectors such as tourism. However, they may require significant resources and continuous stakeholder engagement for effective implementation. **Forster et al. (2024)** focuses on global indicators that are scientifically robust and essential for understanding broad climate trends. While not directly focused on adaptation, they are critical for informing adaptation strategies in the tourism sector, especially for long-term planning and risk management. Both documents highlight the importance of context-specific and globally relevant indicators. For the tourism sector, combining insights from both sets of indicators can provide a comprehensive approach to climate change adaptation, balancing local relevance with global trends.

#### *Extracting Relevant Indicators: Flood et al., (2021)*

The document “Policy Coherence in Adaptation Studies: Selecting and Using Indicators of Climate Resilience” by Flood et al. (2021)<sup>8</sup> provides several unique indicators relevant to tourism and climate change adaptation. Below are some key indicators extracted for their relevance to the tourism sector, along with measures for each indicator:

#### **Climate Parameters:**

1. **Frequency of Temperature Extremes:** Number of days exceeding critical temperature thresholds.

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<sup>8</sup> Flood, S., Dwyer, N., & Gault, J. (2021). *Policy Coherence in Adaptation Studies: Selecting and Using Indicators of Climate Resilience* (Report No. 379). Environmental Protection Agency. Retrieved from [https://www.epa.ie/publications/research/climate-change/Research\\_Report\\_379.pdf](https://www.epa.ie/publications/research/climate-change/Research_Report_379.pdf)

- **Relevance to Tourism:** Impacts the comfort and safety of tourists, especially in destinations with outdoor activities.
  - **Strengths:** Provides insight into extreme temperature events which can affect tourist health and activity participation.
  - **Limitations:** Requires precise and long-term temperature data; regional variations may affect applicability.
  - **Measure:** Number of days per year where the temperature exceeds a defined threshold (e.g., 35°C).
2. **Seasonal Climate Variability:** Changes in seasonal temperature and precipitation patterns.
- **Relevance to Tourism:** Affects the timing and availability of seasonal tourism activities.
  - **Strengths:** Helps in planning and managing seasonal tourism offerings.
  - **Limitations:** Complex to measure and predict accurately; influenced by multiple climatic factors.
  - **Measure:** Average deviation in temperature and precipitation from historical seasonal norms over a specified period (e.g., 10 years).

#### **Climate Impacts:**

1. **Damage to Coastal Infrastructure:** Number of incidents and cost of repair.
- **Relevance to Tourism:** Directly impacts the availability and quality of coastal tourism facilities.
  - **Strengths:** Quantifiable and directly linked to climate impacts on tourism infrastructure.
  - **Limitations:** Requires comprehensive data on infrastructure damage and repair costs.
  - **Measure:** Number of reported damage incidents per year and associated repair costs (in local currency).
2. **Changes in Biodiversity:** Number of species affected by climate change in tourist areas.
- **Relevance to Tourism:** Biodiversity is a key attraction for eco-tourism and nature-based tourism.
  - **Strengths:** Highlights the ecological impacts of climate change, which are important for nature tourism.
  - **Limitations:** Difficult to measure and requires extensive ecological monitoring.
  - **Measure:** Number of species observed in designated tourist areas over time and the number of species showing negative impacts attributed to climate change.

#### **Adaptation Action:**

1. **Implementation of Sustainable Tourism Practices:** Number of tourism businesses adopting sustainable practices.
- **Relevance to Tourism:** Promotes resilience and sustainability in the tourism sector.

- **Strengths:** Encourages the adoption of best practices and can be tracked over time.
  - **Limitations:** The effectiveness depends on the scale and consistency of adoption.
  - **Measure:** Percentage of tourism businesses in a region that have implemented recognized sustainable practices (e.g., water conservation, energy efficiency).
2. **Investment in Green Infrastructure:** Amount of investment in infrastructure that supports climate adaptation.
- **Relevance to Tourism:** Ensures that tourism infrastructure can withstand climate impacts.
  - **Strengths:** Reflects commitment to sustainable development and adaptation.
  - **Limitations:** Measuring the effectiveness of investments can be challenging; data availability may vary.
  - **Measure:** Total monetary value (in local currency) of investments made in green infrastructure projects annually.

### **Adaptation Results:**

1. **Tourist Satisfaction and Safety:** Surveys and reports on tourist experiences regarding climate impacts.
- **Relevance to Tourism:** Direct feedback on how climate adaptation measures are perceived by tourists.
  - **Strengths:** Provides qualitative data on the effectiveness of adaptation measures.
  - **Limitations:** Subjective and may require large sample sizes for accuracy.
  - **Measure:** Average satisfaction rating from tourist surveys on a scale of 1 to 10 regarding climate adaptation and safety measures.
2. **Economic Resilience of Tourism Sector:** Changes in revenue stability and employment in the tourism sector.
- **Relevance to Tourism:** Measures the economic impact of climate adaptation on the tourism industry.
  - **Strengths:** Directly links adaptation measures to economic outcomes.
  - **Limitations:** Influenced by various external factors beyond climate adaptation.
  - **Measure:** Annual percentage change in tourism revenue and employment rates in the tourism sector compared to previous years.

*Extracting Relevant Indicators: Flood et al., (2021)*

The document “Climate change adaptation indicators for the natural environment”<sup>9</sup> (Williams, 2010) provides several unique indicators relevant to tourism and climate change adaptation. Below are some key indicators extracted for their relevance to the tourism sector, along with measures for each indicator:

#### **Climate Parameters:**

1. **Extent of Semi-Natural Habitat:** Area (hectares)
  - **Relevance to Tourism:** Ensures the availability of natural attractions and biodiversity, which are critical for eco-tourism.
  - **Strengths:** Provides a measure of habitat availability and potential for biodiversity.
  - **Limitations:** Does not account for the quality or connectivity of the habitat.
  - **Measure:** Total area of semi-natural habitats in hectares.
2. **Land Cover Dominance and Plant Diversity:** Percentage of total land cover
  - **Relevance to Tourism:** Diverse landscapes enhance the aesthetic and recreational value of tourist destinations.
  - **Strengths:** Indicates landscape diversity and potential for varied tourist experiences.
  - **Limitations:** Requires detailed land cover mapping; may not capture micro-level diversity.
  - **Measure:** Percentage of different land cover types and plant species diversity.

#### **Climate Impacts:**

1. **Coastal Habitat Creation:** Area of newly created habitats (hectares)
  - **Relevance to Tourism:** Enhances coastal resilience, benefiting tourism infrastructure and activities.
  - **Strengths:** Directly measures efforts to mitigate coastal erosion and flooding.
  - **Limitations:** Requires long-term monitoring to assess effectiveness.
  - **Measure:** Hectares of newly created coastal habitats.
2. **Good Ecological Status of Water Bodies:** Number of water bodies meeting ecological standards
  - **Relevance to Tourism:** Ensures water quality for recreational activities and enhances the natural appeal of destinations.
  - **Strengths:** Comprehensive measure of water quality and ecosystem health.
  - **Limitations:** May be influenced by non-climatic factors like pollution.
  - **Measure:** Number of water bodies classified as having good ecological status.

#### **Adaptation Action:**

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<sup>9</sup> Williams, N. (2010). *Climate change adaptation indicators for the natural environment* (NECR038). Natural England. Retrieved from <https://www.naturalengland.org.uk/>

1. **Air Quality:** Number of days exceeding pollution standards
  - **Relevance to Tourism:** Directly impacts tourist health and comfort.
  - **Strengths:** Easy to measure and communicate; directly linked to public health.
  - **Limitations:** Does not measure the overall air quality improvement over time.
  - **Measure:** Number of days per year air pollution levels exceed national standards.
2. **Nitrogen Deposition:** Area of land exceeding critical nitrogen loads
  - **Relevance to Tourism:** Affects ecosystem health and the visual appeal of natural landscapes.
  - **Strengths:** Provides a clear measure of nitrogen pollution impacts.
  - **Limitations:** Requires extensive monitoring and mapping.
  - **Measure:** Hectares of land where nitrogen deposition exceeds critical loads.

#### **Adaptation Results:**

1. **Bird Population Indices:** Population index (relative to baseline year)
  - **Relevance to Tourism:** Birds are key attractions for wildlife tourism and indicators of ecosystem health.
  - **Strengths:** Widely monitored and understood; indicates broader ecological health.
  - **Limitations:** Influenced by various factors beyond climate change.
  - **Measure:** Annual population index for different bird classes.
2. **Area of Land Under Conservation Agreements:** Area (hectares)
  - **Relevance to Tourism:** Ensures the protection and sustainable use of natural areas.
  - **Strengths:** Directly links conservation efforts to land management practices.
  - **Limitations:** The effectiveness depends on the enforcement and management of agreements.
  - **Measure:** Total area of land under conservation agreements in hectares.

The systematic literature review has revealed a diverse set of climate change adaptation indicators that are applicable to the tourism sector. These indicators span across various categories including climate parameters, climate impacts, adaptation actions, and adaptation results. By examining these indicators, we can assess their relevance and effectiveness in the context of tourism, particularly in coastal regions that are highly vulnerable to climate change.



## 4. Engagement with Stakeholders

### 4.1 Summary of Needs, Capacities, and Preferences Regarding CC Adaptation Monitoring

Engagement with stakeholders has been instrumental in understanding the diverse needs, capacities, and preferences regarding climate change (CC) adaptation monitoring. The insights gathered from the questionnaire responses are summarized below, highlighting key areas that are crucial for the development and implementation of effective monitoring systems.

#### **Needs:**

##### **1. Comprehensive Data Collection:**

- Project stakeholders expressed the necessity for robust data collection mechanisms that can accurately track climate impacts and adaptation efforts. They emphasized the importance of having access to both historical and real-time data to monitor changes and trends effectively.

##### **2. Relevant and Context-Specific Indicators:**

- There is a strong demand for indicators that are specifically tailored to the unique contexts of the regions involved. Stakeholders stressed the need for indicators that reflect local vulnerabilities, socio-economic conditions, and environmental factors to ensure meaningful and actionable insights.

##### **3. Integration with Existing Systems:**

- Many stakeholders indicated a preference for adaptation monitoring systems that can be seamlessly integrated with existing monitoring and evaluation (M&E) frameworks. Such integration helps in leveraging existing data and resources, minimizing redundancy, and ensuring a coherent approach to tracking adaptation progress.

##### **4. Support for Decision-Making:**

- Monitoring systems need to provide actionable insights that can support decision-making processes at various levels. Stakeholders highlighted the necessity for indicators that can inform policy development, strategic planning, and resource allocation effectively.

#### **Capacities:**

##### **1. Technical Expertise:**

- While some stakeholders possess strong technical capabilities for data collection and analysis, others require capacity-building support. There is a varied level of expertise in using advanced tools and technologies for climate data monitoring and interpretation among the partners.

##### **2. Financial Resources:**

- The availability of financial resources for establishing and maintaining adaptation monitoring systems is a significant concern. Some stakeholders operate with limited budgets and therefore need cost-effective solutions that do not compromise the quality of data and analysis.

### 3. Institutional Support:

- The effectiveness of adaptation monitoring is often linked to the level of institutional support available. Stakeholders with well-established institutional frameworks are better positioned to implement comprehensive monitoring systems, while those with fragmented or evolving institutional structures may face challenges in coordination and implementation.

### 4. Stakeholder Engagement:

- Engaging a broad range of stakeholders, including local communities, government agencies, and private sector actors, is crucial. Partners highlighted the importance of participatory approaches in the design and implementation of monitoring systems to ensure relevance and buy-in.

## Preferences:

### 1. User-Friendly Tools:

- There is a preference for monitoring tools that are user-friendly and accessible to a wide range of users, including those with limited technical expertise. Simplified interfaces and clear guidelines are essential for effective use and widespread adoption.

### 2. Flexible and Adaptive Systems:

- Monitoring systems should be flexible enough to adapt to changing conditions and new information. Stakeholders prefer systems that can evolve with advancements in technology and shifts in climate patterns, ensuring long-term relevance and effectiveness.

### 3. Regular Reporting and Feedback:

- Regular reporting mechanisms that provide timely feedback on adaptation progress are highly valued. Stakeholders emphasized the need for periodic reviews and updates to keep stakeholders informed and engaged, facilitating continuous improvement and accountability.

### 4. Emphasis on Learning and Improvement:

- There is a strong emphasis on using monitoring systems as tools for learning and continuous improvement. Stakeholders prefer approaches that not only track progress but also identify areas for enhancement and facilitate the sharing of best practices across regions and sectors.

In conclusion, the engagement with project stakeholders reveals a clear demand for comprehensive, context-specific, and integrated monitoring systems that support informed decision-making and promote continuous learning. Addressing the varied capacities and preferences of stakeholders will be critical in designing effective climate change adaptation monitoring frameworks, ultimately enhancing tourism destinations' resilience to climate change.

## 5. Alignment with CLIMATE-ADAPT

The CLIMATE-ADAPT platform<sup>10</sup>, a collaboration between the European Commission and the European Environment Agency, provides a comprehensive collection of climate change indicators. These indicators encompass observed and projected climate changes, their impacts, and adaptation needs at the regional level in Europe. The platform's indicators are designed to support policy development and implementation by providing essential data for assessing climate impacts and adaptation strategies.

The following comprehensive list of unique indicators is relevant to monitoring the impacts of climate change on tourism in the Mediterranean region. Each indicator includes its measurement and a brief description.

1. **Heatwave Days:**
  - **Measurement:** Number of days with temperatures exceeding a specific threshold.
  - **Description:** Measures heat stress on tourists, impacting their comfort and health.
2. **Tropical Nights:**
  - **Measurement:** Nights where temperatures remain above a specific threshold.
  - **Description:** Affects nighttime comfort and sleep quality for tourists.
3. **Extreme Precipitation Days:**
  - **Measurement:** Number of days with significant rainfall.
  - **Description:** Important for assessing flood risks and impacts on outdoor tourism activities.
4. **Total Precipitation:**
  - **Measurement:** Cumulative rainfall over a specific period.
  - **Description:** Influences water availability, landscape, and suitability for outdoor activities.
5. **Sea-Level Rise:**
  - **Measurement:** Long-term increases in sea levels.
  - **Description:** Impacts coastal tourism infrastructure, beaches, and facilities.
6. **Extreme Sea Levels:**
  - **Measurement:** Instances of unusually high sea levels due to tides, storms, and other factors.
  - **Description:** Crucial for flood risk assessments and coastal area management.
7. **Fire Weather Index:**
  - **Measurement:** Scale indicating the risk of fire in an area based on weather conditions.
  - **Description:** Important for safety, natural landscape preservation, and tourism activities in forested areas.

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<sup>10</sup> European Environment Agency. (2024). Climate-ADAPT indicators. European Commission. Retrieved July 7, 2024, from <https://climate-adapt.eea.europa.eu/en/knowledge/c-a-indicators>

8. **Drought Indicators:**

- **Measurement:** Measures of prolonged periods of low precipitation.
- **Description:** Affect water resources, landscape attractiveness, and the viability of certain tourism activities.

9. **Sea Surface Temperature:**

- **Measurement:** Monitoring changes in sea temperature.
- **Description:** Affects marine biodiversity, swimming, and diving activities.

10. **Ocean Acidification:**

- **Measurement:** Changes in pH levels in seawater.
- **Description:** Influences marine life health, impacting activities like snorkeling and diving.

11. **Tourism Revenue:**

- **Measurement:** Revenue generated from tourism.
- **Description:** Affected by climate-induced changes in tourist arrivals and activities.

12. **Employment in Tourism:**

- **Measurement:** Number of jobs in the tourism sector.
- **Description:** Sensitive to fluctuations in tourist numbers due to climate impacts.

13. **Cost of Climate Adaptation:**

- **Measurement:** Investments required to adapt infrastructure to climate change.
- **Description:** Important for budgeting, planning, and ensuring sustainable tourism.

14. **Insurance Costs:**

- **Measurement:** Changes in insurance premiums for tourism-related properties.
- **Description:** Reflects increased risks from climate impacts on tourism infrastructure.

15. **Tourist Satisfaction:**

- **Measurement:** Surveys and feedback from tourists.
- **Description:** Influenced by climate conditions and their impact on tourist experience.

16. **Local Community Attitudes:**

- **Measurement:** Surveys on local perceptions of tourism and climate change.
- **Description:** Important for community support and sustainable tourism development.

17. **Cultural Heritage Preservation:**

- **Measurement:** Status of cultural heritage sites.
- **Description:** Vulnerable to climate impacts like flooding or extreme weather, affecting tourism attractiveness.

**18. Public Health:**

- **Measurement:** Incidence of heat-related illnesses among tourists and locals.
- **Description:** Reflects health impacts of extreme temperatures on the tourism industry.

**19. Climate Adaptation Policies:**

- **Measurement:** Existence and implementation of policies aimed at adapting tourism to climate change.
- **Description:** Reflects governance quality and preparedness.

**20. Funding for Adaptation Projects:**

- **Measurement:** Amount of funding allocated for climate adaptation in tourism.
- **Description:** Indicates prioritization by governments and readiness for climate resilience.

**21. Stakeholder Involvement:**

- **Measurement:** Level of involvement of local stakeholders in climate adaptation planning.
- **Description:** Ensures inclusive and effective adaptation strategies.

**22. Regulatory Frameworks:**

- **Measurement:** Existence of regulations to mitigate climate impacts on tourism.
- **Description:** Ensures compliance and enforcement for sustainable tourism practices.

**23. Species Distribution Changes:**

- **Measurement:** Tracking the movement of species due to climate shifts.
- **Description:** Important for eco-tourism and wildlife viewing experiences.

**24. Habitat Loss and Degradation:**

- **Measurement:** Extent and quality of habitats.
- **Description:** Affects natural attractions and biodiversity-based tourism.

**25. Water Quality:**

- **Measurement:** Levels of pollutants in water bodies.
- **Description:** Important for water-based tourism activities and overall environmental health.

**26. Protected Areas:**

- **Measurement:** Extent and condition of protected natural areas.
- **Description:** Crucial for nature-based tourism and conservation efforts.

These indicators provide a comprehensive framework for assessing the diverse impacts of climate change on tourism in the Mediterranean region, facilitating holistic and informed decision-making ([European Union](#)) ([European Environment Agency's home page](#)) ([Water Information System](#)) ([Water Information System](#)) ([BIS for Europe](#)) ([FISE](#)).

## 6. Indicator Refinement and Selection

### 6.1 Drawing conclusions from previous analysis

#### Section 3: Systematic Literature Review

The literature review underscored the importance of robust monitoring and evaluation (M&E) systems for climate change adaptation in the tourism sector. Effective M&E systems enable the assessment of progress, identification of improvement areas, and assurance of accountability among stakeholders. They provide data essential for informed decision-making and strategic planning, thereby promoting resilience in coastal tourism destinations.

Key takeaways from the literature include the necessity for:

- **Conceptual Clarity and Flexibility:** Clear definitions and adaptable frameworks are vital for successful adaptation. This allows stakeholders to modify systems as understanding evolves.
- **Integration with Existing Systems:** Aligning new M&E systems with existing frameworks leverages current data and resources, facilitating smoother implementation.
- **Stakeholder Engagement:** Involving a broad range of stakeholders ensures that the M&E system meets diverse needs and fosters ownership and support for its implementation.
- **Resource and Capacity Building:** Significant resources and ongoing capacity building are crucial for sustaining effective M&E systems.
- **Incremental and Iterative Approach:** Starting with pilot projects or specific sectors helps in gradually building comprehensive M&E systems, allowing for learning and adjustments.
- **High-Quality Data Management:** Reliable and accessible data is critical for credible M&E, with a focus on ensuring data quality and consistency.
- **Learning-Oriented Systems:** Emphasizing learning as a core objective, with regular reviews and knowledge-sharing platforms to improve adaptation strategies over time.
- **Political Will and Leadership:** Strong political commitment and leadership drive the establishment and sustainability of M&E systems.

From various sources, specific indicators relevant to tourism and climate change adaptation were identified, such as changes in annual temperature, number of hot days, properties flooded per year, and public awareness campaigns on water efficiency.

#### Section 4: Stakeholder Analysis

Stakeholder engagement revealed diverse needs, capacities, and preferences regarding climate change adaptation monitoring:

- **Data Collection Needs:** Robust mechanisms for accurate tracking of climate impacts and adaptation efforts are essential.
- **Context-Specific Indicators:** Indicators should reflect local vulnerabilities, socio-economic conditions, and environmental factors to provide meaningful insights.
- **Integration with Existing Frameworks:** Seamless integration with current M&E systems is preferred to leverage existing data and resources.

- **Support for Decision-Making:** Monitoring systems must provide actionable insights to inform policy development, strategic planning, and resource allocation.
- **Technical Expertise and Capacity Building:** Varied levels of expertise among stakeholders necessitate continuous capacity building and support.
- **Financial Constraints:** Cost-effective solutions are crucial, especially for stakeholders with limited budgets.
- **Institutional Support and Stakeholder Engagement:** Strong institutional frameworks and broad stakeholder engagement are key for effective implementation.
- **User-Friendly and Adaptive Systems:** Monitoring tools should be accessible, flexible, and capable of evolving with changing conditions and advancements in technology.
- **Regular Reporting and Feedback:** Regular updates and feedback mechanisms are valued for keeping stakeholders informed and engaged, promoting continuous improvement.

### Section 5: Alignment with CLIMATE-ADAPT

The CLIMATE-ADAPT platform provides a comprehensive collection of climate change indicators designed to support policy development and implementation. These indicators are crucial for assessing climate impacts and adaptation needs at regional levels. Relevant indicators from this platform for tourism include, among others:

- **Heatwave Days and Tropical Nights:** Assess heat stress on tourists.
- **Extreme Precipitation Days and Total Precipitation:** Evaluate flood risks and water availability.
- **Sea-Level Rise and Extreme Sea Levels:** Understand impacts on coastal tourism infrastructure.
- **Fire Weather Index and Drought Indicators:** Assess risks to natural landscapes and water resources.
- **Sea Surface Temperature and Ocean Acidification:** Evaluate impacts on marine biodiversity and related tourism activities.

### Summary and Path Forward

The major conclusions from the literature review, stakeholder analysis, and alignment with CLIMATE-ADAPT form the basis for refining and selecting indicators for monitoring climate change impacts on tourism in the Mediterranean region. The next steps will involve proposing specific indicators that are feasible, relevant, and actionable, ensuring they support effective adaptation strategies and enhance the resilience and sustainability of tourism destinations. By focusing on these insights, stakeholders can develop robust M&E systems that facilitate informed decision-making and promote sustainable tourism practices.

## 7. Suggested Indicators

Based on the analysis of major conclusions from sections 3, 4, and 5, and considering the context of the consultancy report and the aim of effective monitoring and evaluation of climate change impacts on tourism in the Mediterranean region, the following refined indicators are proposed. These indicators are categorized into physical and environmental, economic, sociocultural, governance and policy, and biodiversity and ecosystem health indicators.

### 7.1 Physical and Environmental Indicators

#### 1. Change in Annual Temperature

- **Definition:** Measures deviations from the long-term average annual temperature.
- **Rationale:** Temperature changes directly affect tourist comfort and seasonality, influencing tourism patterns and infrastructure needs.
- **Measurement:** Degree Celsius change per year from a long-term average baseline (30 years).

#### 2. Number of Hot Days

- **Definition:** Counts the number of days per year exceeding a critical temperature threshold (e.g., 35°C).
- **Rationale:** Indicates stress levels on tourists and tourism infrastructure during heatwaves, affecting health and activity participation.
- **Measurement:** Number of days per year with maximum temperatures above the threshold.

#### 3. Sea-Level Rise

- **Definition:** Monitors the long-term increase in sea levels.
- **Rationale:** Rising sea levels threaten coastal tourism infrastructure, beaches, and natural attractions, necessitating adaptation strategies.
- **Measurement:** Millimeters per year, measured using tide gauges and satellite altimetry.

#### 4. Extreme Precipitation Days

- **Definition:** Counts the number of days with significant rainfall above a certain threshold.
- **Rationale:** Important for assessing flood risks, impacting outdoor tourism activities and infrastructure.
- **Measurement:** Number of days per year with precipitation exceeding a set threshold (e.g., 50 mm).

#### 5. Fire Weather Index

- **Definition:** A scale indicating the risk of fire based on weather conditions.



- **Rationale:** Important for safety and natural landscape preservation, especially in forested tourist areas.
- **Measurement:** Fire Weather Index (FWI) values calculated daily.

## 7.2 Economic Indicators

### 1. Tourism Revenue Variability

- **Definition:** Measures changes in tourism revenue over time.
- **Rationale:** Indicates the economic impact of climate variability on tourism revenue, reflecting the sector's resilience.
- **Measurement:** Percentage change in tourism revenue annually, adjusted for inflation.

### 2. Cost of Climate Adaptation

- **Definition:** Tracks investments required to adapt tourism infrastructure to climate change.
- **Rationale:** Important for budgeting, planning, and ensuring sustainable tourism.
- **Measurement:** Monetary value (in local currency) of adaptation investments annually.

### 3. Insurance Costs

- **Definition:** Measures changes in insurance premiums for tourism-related properties.
- **Rationale:** Reflects increased risks from climate impacts on tourism infrastructure.
- **Measurement:** Percentage change in insurance premiums annually.

## 7.3 Sociocultural Indicators

### 1. Tourist Satisfaction

- **Definition:** Assesses satisfaction levels of tourists regarding their experiences.
- **Rationale:** Influenced by climate conditions and their impact on tourist experience, essential for tourism management.
- **Measurement:** Average satisfaction rating from tourist surveys on a scale of 1 to 10.

### 2. Local Community Attitudes

- **Definition:** Surveys local perceptions of tourism and climate change.
- **Rationale:** Important for community support and sustainable tourism development.
- **Measurement:** Percentage of positive responses in community surveys regarding tourism and climate change adaptation.

### 3. Public Awareness Campaigns on Water Efficiency

- **Definition:** Number of campaigns aimed at promoting sustainable water use practices.

- **Rationale:** Encourages sustainable practices among tourists and businesses, mitigating water scarcity impacts.
- **Measurement:** Number of campaigns conducted annually.

## 7.4 Governance and Policy Indicators

### 1. Climate Adaptation Policies

- **Definition:** Existence and implementation of policies aimed at adapting tourism to climate change.
- **Rationale:** Reflects governance quality and preparedness for climate resilience.
- **Measurement:** Qualitative assessment of policy presence and implementation status.

### 2. Funding for Adaptation Projects

- **Definition:** Amount of funding allocated for climate adaptation in tourism.
- **Rationale:** Indicates prioritization by governments and readiness for climate resilience.
- **Measurement:** Monetary value (in local currency) of allocated funds annually.

### 3. Stakeholder Involvement

- **Definition:** Level of involvement of local stakeholders in climate adaptation planning.
- **Rationale:** Ensures inclusive and effective adaptation strategies.
- **Measurement:** Number of stakeholder meetings and participation rates annually.

## 7.5 Biodiversity and Ecosystem Health Indicators

### 1. Species Distribution Changes

- **Definition:** Tracks the movement of species due to climate shifts.
- **Rationale:** Important for eco-tourism and wildlife viewing experiences.
- **Measurement:** Number of species showing significant distribution changes annually.

### 2. Habitat Loss and Degradation

- **Definition:** Measures the extent and quality of natural habitats.
- **Rationale:** Affects natural attractions and biodiversity-based tourism.
- **Measurement:** Area (hectares) of habitat lost or degraded annually.

### 3. Water Quality

- **Definition:** Levels of pollutants in water bodies used for tourism activities.
- **Rationale:** Important for water-based tourism activities and overall environmental health.

- **Measurement:** Concentration of key pollutants (e.g., nitrates, phosphates) in water samples taken quarterly.

#### 4. **Protected Areas**

- **Definition:** Extent and condition of protected natural areas.
- **Rationale:** Crucial for nature-based tourism and conservation efforts.
- **Measurement:** Area (hectares) under protection and assessment of ecological condition annually.

These indicators provide a comprehensive framework for assessing the diverse impacts of climate change on tourism in the Mediterranean region. They facilitate informed decision-making, support effective adaptation strategies, and enhance the resilience and sustainability of tourism destinations.

## 8. Outcome and Recommendations

### 8.1 Summary of the Curated Set of Indicators

The curated set of indicators is designed to comprehensively monitor the impacts of climate change on tourism in the Mediterranean region. These indicators are categorized into physical and environmental, economic, sociocultural, governance and policy, and biodiversity and ecosystem health indicators. Each indicator includes its definition, rationale, and measurement method.

#### Physical and Environmental Indicators:

1. **Change in Annual Temperature:** Measures temperature deviations to assess impacts on tourist comfort and seasonality.
2. **Number of Hot Days:** Tracks days with extreme heat, critical for health and safety planning.
3. **Sea-Level Rise:** Monitors long-term sea level changes, affecting coastal infrastructure.
4. **Extreme Precipitation Days:** Evaluates flood risks impacting tourism activities and infrastructure.
5. **Fire Weather Index:** Indicates fire risk based on weather conditions, important for safety.

#### Economic Indicators:

1. **Tourism Revenue Variability:** Measures economic impacts of climate variability on tourism revenue.
2. **Cost of Climate Adaptation:** Tracks investments in adapting tourism infrastructure.
3. **Insurance Costs:** Measures changes in insurance premiums for tourism properties.

#### Sociocultural Indicators:

1. **Tourist Satisfaction:** Assesses tourist experiences and satisfaction levels.
2. **Local Community Attitudes:** Surveys local perceptions of tourism and climate change.
3. **Public Awareness Campaigns on Water Efficiency:** Promotes sustainable water use practices.

#### Governance and Policy Indicators:

1. **Climate Adaptation Policies:** Evaluates the existence and implementation of adaptation policies.
2. **Funding for Adaptation Projects:** Measures financial commitment to adaptation initiatives.
3. **Stakeholder Involvement:** Tracks engagement of local stakeholders in adaptation planning.

#### Biodiversity and Ecosystem Health Indicators:

1. **Species Distribution Changes:** Monitors species movement due to climate shifts.
2. **Habitat Loss and Degradation:** Measures the extent and quality of natural habitats.
3. **Water Quality:** Assesses pollutant levels in water bodies.
4. **Protected Areas:** Evaluates the extent and condition of protected natural areas.

### 8.2 How These Indicators Will Guide Data Collection, Analysis, and Reporting Data Collection

Implementing a **systematic approach** is essential for ensuring consistency and accuracy in data collection for each indicator. This involves establishing standardized protocols that outline specific methodologies, timeframes, and responsible parties for data gathering. By adhering to these protocols, stakeholders can ensure that data collected from various sources are comparable and reliable over time.

**Advanced technologies** play a crucial role in enhancing data collection efforts. The use of remote sensing, Geographic Information Systems (GIS), and Internet of Things (IoT) devices allows for real-time monitoring of climate variables and environmental conditions. These technologies enable the collection of high-resolution spatial and temporal data, providing a comprehensive understanding of climate impacts on tourism.

**Engaging local communities, tourism businesses, and governmental agencies** in data collection efforts is vital for enhancing coverage and reliability. Stakeholder collaboration ensures that diverse perspectives and local knowledge are incorporated into the data collection process. This inclusive approach helps in identifying region-specific impacts and adaptation needs, making the data more relevant and actionable.

### Data Analysis

**Regular trend analyses** are crucial for identifying patterns and changes over time. By analyzing historical and real-time data, stakeholders can detect long-term trends and short-term anomalies in climate variables and their impacts on tourism. This continuous analysis provides insights into the evolving nature of climate risks and helps in assessing the effectiveness of adaptation measures.

**Evaluating climate change's direct and indirect impacts** on tourism requires a comprehensive assessment of the interplay between different indicators. For instance, changes in temperature and precipitation patterns can affect tourist behavior, infrastructure resilience, and local ecosystems. Understanding these interdependencies helps in developing targeted strategies to mitigate negative impacts and enhance the resilience of tourism destinations.

Scenario modeling is another important analytical tool for **predicting the future impacts** of climate change on tourism. By creating different climate scenarios, stakeholders can assess potential risks and opportunities under various conditions. These models inform strategic planning and adaptation measures, enabling proactive decision-making to safeguard tourism assets and resources.

### Reporting

Producing **regular reports** is essential for communicating findings to stakeholders, policymakers, and the public. These reports should be generated periodically, such as quarterly or annually, to provide updates on the status of indicators and the progress of adaptation efforts. Regular reporting ensures transparency and accountability in monitoring climate impacts and adaptation measures.

Reports should be available in multiple formats to ensure **accessibility to a wide audience**. Detailed reports can provide in-depth analysis for technical audiences, while executive summaries highlight key findings for decision-makers. Infographics and interactive dashboards can make the information more engaging and easier for the general public to understand.

**Establishing feedback mechanisms** is critical for refining indicators and improving data collection and analysis processes. By soliciting stakeholder feedback, researchers can identify gaps and challenges in the monitoring system and make necessary adjustments. This iterative process ensures that the indicators remain relevant and effective in capturing climate impacts on tourism, facilitating continuous improvement in adaptation strategies.

## 8.3 Recommendations for Implementation and Monitoring

### Implementation

Establishing a **dedicated institutional framework** is paramount for the effective oversight of the implementation and monitoring of the indicators. This framework could involve setting up a task force or a coordination committee comprising representatives from key stakeholders, including government agencies, tourism businesses, local communities, and environmental organizations. Such a structure ensures that all relevant parties are engaged and that the implementation process is coordinated and efficient.

Investing in **capacity-building programs** for stakeholders involved in data collection and analysis is crucial. These programs should focus on equipping stakeholders with the necessary skills and knowledge to monitor climate impacts on tourism effectively. Training sessions, workshops, and certification courses can help enhance stakeholders' technical capabilities, ensuring that data collection and analysis are conducted accurately and reliably.

**Securing adequate funding** and resources is essential for successfully implementing monitoring systems. This includes financial support for technology acquisition, training programs, and operational costs. Governments, international organizations, and private-sector partnerships can provide the necessary funding. Ensuring that resources are allocated efficiently will support the sustainability of monitoring efforts and enhance the overall effectiveness of climate adaptation strategies.

### Monitoring

**Continuous monitoring systems** are vital for real-time data collection and immediate response to emerging issues. Implementing technologies such as remote sensing, IoT devices, and automated data collection tools can facilitate constant monitoring of climate variables and their impacts on tourism. This real-time data enables prompt decision-making and rapid adaptation to changing conditions.

**Periodic reviews and evaluations** of the monitoring system are necessary to assess its effectiveness, identify gaps, and make necessary adjustments. These reviews should be conducted at regular intervals, such as annually or biannually, and should involve comprehensive assessments of the data collected, the methodologies used, and the overall performance of the monitoring system. Feedback from these evaluations can inform improvements and ensure that the system remains relevant and effective.

**Maintaining ongoing engagement with stakeholders** through workshops, meetings, and collaborative projects is crucial for ensuring their input and buy-in. Regular interactions with stakeholders help to keep them informed about the progress of monitoring efforts and provide opportunities for them to contribute their insights and expertise. This collaborative approach enhances the credibility and acceptance of the monitoring system among all parties involved.

### Integration with Policy

**Aligning** the indicators and monitoring systems with national and regional climate adaptation policies and tourism strategies is essential for ensuring coherence and effectiveness. This alignment helps to integrate climate adaptation efforts into broader policy frameworks, facilitating coordinated action and resource allocation. It also ensures that the monitoring system supports the achievement of policy goals and enhances the overall resilience of the tourism sector.

**Advocacy and awareness campaigns** are important for promoting climate resilience in tourism. Public awareness campaigns, policy dialogues, and stakeholder consultations can help raise awareness about

climate change's impacts on tourism and the need for adaptation measures. These efforts can also foster public support for climate adaptation initiatives and encourage proactive engagement from all stakeholders.

**Fostering collaboration with international organizations and initiatives** can enhance the overall effectiveness of climate adaptation efforts in the tourism sector. International collaboration provides opportunities for sharing best practices, accessing funding, and leveraging global expertise. Partnerships with relevant organizations can support the implementation of robust monitoring systems and facilitate knowledge exchange and capacity building.

## 9. Conclusion

This report aimed to develop a practical, measurable set of indicators for climate change adaptation in the Mediterranean tourism sector. By systematically reviewing relevant literature, engaging stakeholders, and aligning with the CLIMATE-ADAPT platform, we curated a comprehensive framework of indicators spanning physical and environmental, economic, sociocultural, governance and policy, and biodiversity and ecosystem health dimensions.

The selected indicators provide critical insights into the impacts of climate change on tourism, aiding in formulating effective adaptation strategies. These indicators are essential for consistently tracking climate impacts, informing data-driven decision-making, and supporting policy development. The rigorous methodology ensures that these indicators are scientifically robust and contextually relevant to the unique challenges faced by Mediterranean coastal tourism destinations.

The importance of these indicators cannot be overstated. They serve as essential tools for enhancing the tourism sector's resilience, enabling stakeholders to monitor and evaluate the effectiveness of adaptation measures. By providing a clear framework for assessing climate impacts, these indicators facilitate targeted actions that promote sustainable tourism practices, protect environmental and cultural heritage, and ensure the economic viability of tourism destinations.



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