



Regional Tourism Climate Strategy for the Autonomous Region of Sardinia

The Consortium:



Project Information	
Project Acronym	NaTour4CChange
Project Full Title	Governing sustainable tourism in territories with high environmental value: reconnecting tourism and nature for addressing the climate crisis with an ecosystem-based approach
Project Priority	#2: A Greener Med
Project Mission	#4 Enhancing Sustainable Tourism
Specific Objective	#2.4 Promoting climate change adaptation and disaster risk prevention, resilience, taking into account ecosystem-based approaches
Type of Project	Thematic Project
Contract No	
Start date	1 January 2024
Duration	33 months

Deliverable Information	
Deliverable no	2.5.1
Deliverable title	Regional Tourism Climate Strategy
Contractual date of delivery	31.12.2025
Actual date of delivery	
Type of deliverable	External
Nature of deliverable	Report
Work Package	2
Activities	2.5
Partner responsible	Sardinia Region



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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.

Acronyms

- **CC:** Climate Change
- **CdI:** Impact Chain
- **NT4CC:** NaTour4ClimateChange
- **P/P:** Plans/Programs
- **SRACC:** Regional Strategy for Adaptation to Climate Change
- **SVASI:** Environmental Sustainability, Strategic Assessment and Information Systems Service
- **TTI:** Interdepartmental Technical Table



1. INTRODUCTION

With the intensification of climate change in the Mediterranean, Sardinia must face growing hazards – rising temperatures, increasing duration and frequency of heatwaves, increasing extreme temperatures, reduction of the average annual rainfall accumulation, high intensity and frequency of extreme weather events, increasing duration and frequency of drought periods – which directly threaten its tourism-dependent economy.

Sardinia is a renowned destination in the national and international tourism landscape thanks to the presence of significant resources of exceptional artistic, historical, and archaeological value, in addition to invaluable environmental and landscape wealth, known above all for the great variety of enchanting beaches that stretch over 1,851 km of coastline and stand out for the presence of crystal-clear waters and high-quality sand.

Tourism undoubtedly plays a fundamental role in the socio-economic framework of the Island, mainly based on coastal tourism. This is considered one of the main vectors of significant environmental pressures and impacts. The potential negative effects of tourism development can be traced back to numerous different impacts, but the reverse is also true: the tourism sector is strongly influenced by climate change.

Although over the years new formulas of enjoyment have been encouraged, based on the enhancement of other identity elements, the lengthening of the season and a greater focus on environmental sustainability, the impacts of climate change, in particular for the coastal sector and its tourism industry, remain a relevant factor on which to concentrate efforts and planning activities towards resilience against the impacts of climate change, in a long-term perspective. [cite: 63]

To this end, for several years now, the Sardinia Region has been investing resources and carrying out different activities, both technical and regarding governance, to address the issue of Climate Change (CC). First and foremost, the drafting of the **Regional Strategy for Adaptation to Climate Change (SRACC)**, updated and adopted in 2019 with the Regional Council Resolution no. 6/50 of February 5, 2019, which aims to address the climate challenge by anticipating the expected scenarios, mitigating the effects, and implementing adaptation measures tailored to the specific needs of the territories, consistently with and in implementation of the Regional Strategy for Sustainable Development (Regional Council Resolution no. 39/56 of October 8, 2021).

To accompany and support the SRACC implementation process, it has put in place a series of initiatives and projects (including, for example, DESIRMED “Demonstration



and mainstreaming of nature-based Solutions for climate Resilient transformation in the MEDiterranean” (Horizon program), D4N – “Dialogue for Nature” (Interreg EuroMED program) and the NaTour4CChange – NT4CC project itself) and has activated a **regional-level coordination structure** identifying various bodies including:

- a) Institutional steering committee, as a regional coordination structure for integration into the strategies and policies of the regional administration;
- b) Interdepartmental working group (GdLI), composed of the Directorates General whose competencies involve the adoption of climate change adaptation measures, which supports the steering committee;
- c) Thematic tables which, activated as part of the GdLI's work, act for a transversal integration of climate change adaptation at all levels and sectors of programming and planning;
- d) Local authorities of Sardinia, identified among the actors responsible for the implementation of the regional adaptation process by virtue of the fundamental role they play through the adoption of the instruments within their competence.

In particular, within the framework of the NT4CC project, an **Interdepartmental Technical Table (TTI)** was established for the elaboration of the **Regional Strategy for Adaptation to Climate Change for coastal tourism** and to define orientations, guidelines, recommendations, and methods for the integration of climate considerations into the instruments of their respective competence. The TTI is composed of regional actors operating within the Departments most involved in the relevant topics. Specifically:

- the Department of Environmental Defense;
- the Department of Tourism, Crafts and Commerce;
- the Department of Local Authorities, Finance and Urban Planning;
- the Department of Public Education, Cultural Heritage, Information, Entertainment and Sports;
- the General Directorate of Civil Protection.

The Department of Environmental Defense has therefore initiated a **participatory process** with these Regional Departments, with the aim of identifying, based on the guidelines and needs expressed by the TTI, the strategic and thematic priorities necessary for structuring the Strategy for the Sardinia Region. A joint work aimed at promoting the popularization, dissemination of knowledge and educational deepening, with the aim of creating a common knowledge base and strengthening



communication, discussion, institutional and coordination capacity among the Departments in the context of CC adaptation.

The elaborated Regional Strategy for Adaptation to Climate Change for coastal tourism has as its **main purpose** to define guidelines and measures to integrate Climate Change adaptation for the coastal sector within the various planning and programming instruments under the competence of the regional authority. This path therefore takes on meta-objectives that represent the long-term vision, i.e., general and specific *process* and regional governance goals, and specific objectives, i.e., operational *plan* objectives aimed at understanding how CC impact the coastal area, with a focus on the tourism sector, and identifying mitigation/adaptation solutions for the connected risks, based on the scope of action of the strategy explored in the participatory process.

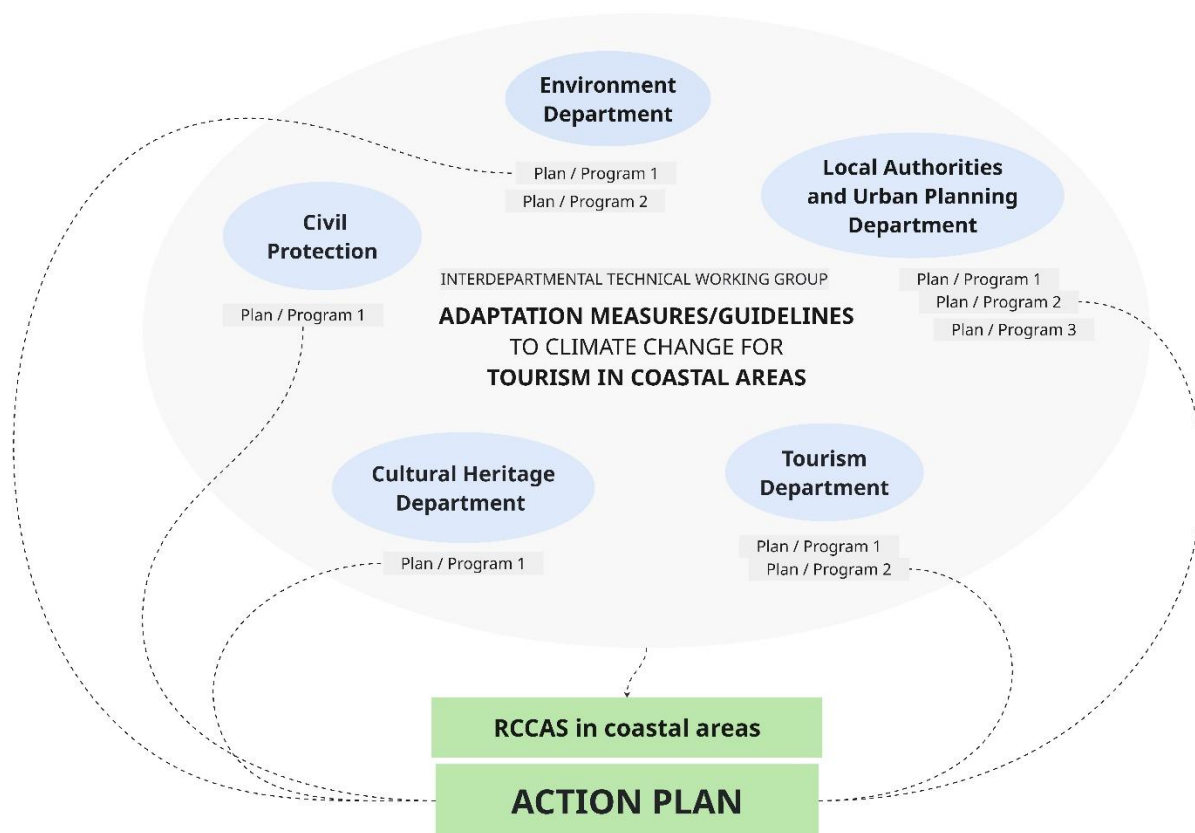


FIGURE 1. OPERATING SCHEME OF THE TTI FOR THE IMPLEMENTATION OF THE SRACC FOR COASTAL TOURISM

The path that accompanied the drafting of the Strategy was functional to providing a methodological and strategic basis for planning CC adaptation, raising technical skills



and awareness on the issue of CC. The **methodological approach adopted** for its elaboration, namely the *participatory process*, allowed for collecting, analyzing, and interpreting the information used to build subsequent evaluations. The participatory activities were oriented towards defining the adaptation options to contrast the identified risks and vulnerabilities and the categories of adaptation actions, also starting from the database of the National Plan for Adaptation to Climate Change (PNACC).

The methodological path, shown in the figure below, saw an initial phase divided into two distinct parts, the contents of which are functional to outlining a general cognitive framework. The first part analyzed the evolution and projections of climate change at a regional scale, with particular reference to the coastal context of the Sardinia Region. The second part focused on the overall framework of the tourism sector, with specific attention to the dynamics and trends that characterize the regional coastal areas.

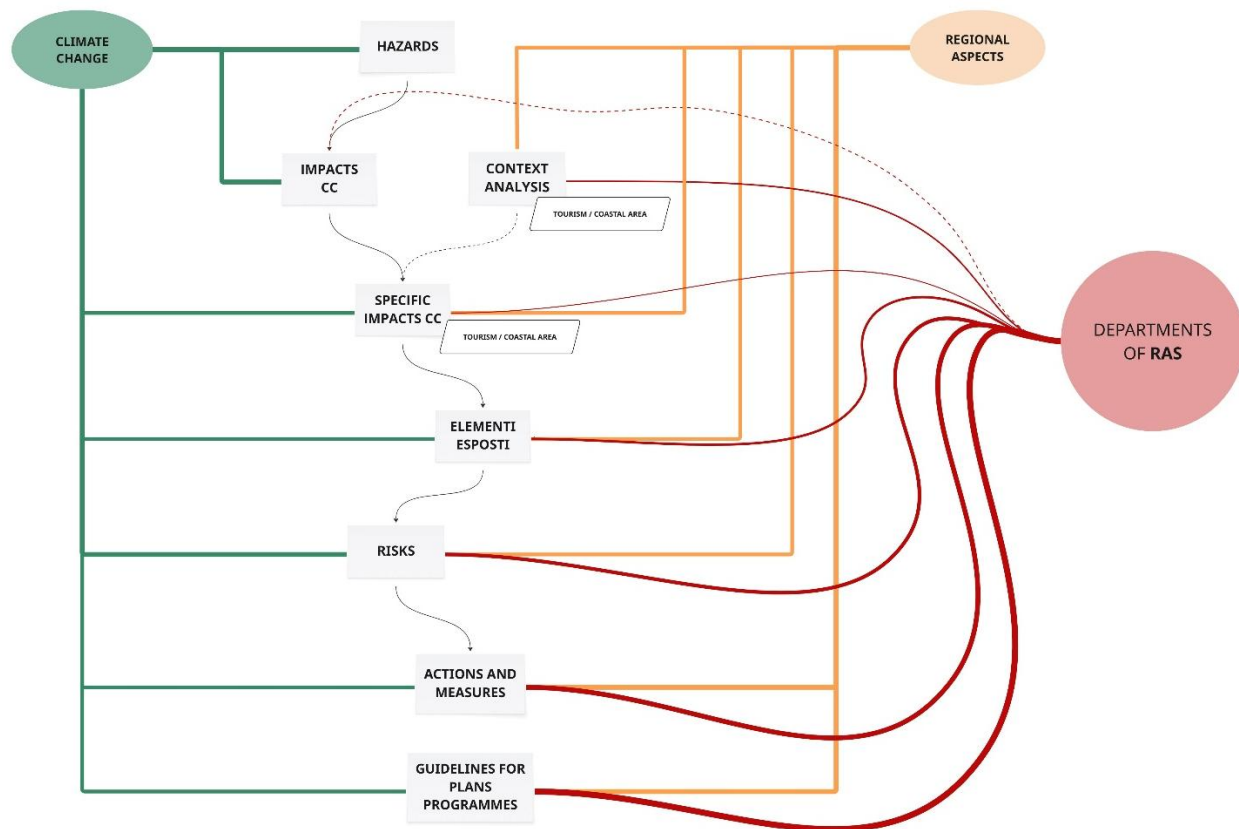


FIGURE 2. SCHEME OF THE METHODOLOGICAL PATH THAT ACCOMPANIED THE DEEPENING OF KNOWLEDGE AND CONTENTS OF THE SRACC FOR COASTAL TOURISM

Based on this shared knowledge base, the specific impacts of climate change on coastal tourism were defined through the construction of **impact chains** that allow



for the identification of exposed elements and the most relevant risks for the different stakeholders and departments involved in the working table. This framework accompanied the subsequent definition of operational interventions and measures aimed at achieving the identified objectives, namely the reduction of high risks weighing on the exposed elements of greatest interest, through integrated actions of mitigation and adaptation to climate change.

The cognitive framework underlying the action plan is built on the basis of analyses and in-depth studies carried out by experts in the various disciplinary sectors involved in the process, regarding the issue of CC and the territorial aspects specific to the regional context. This framework constitutes the indispensable scientific, technical, and cognitive basis for understanding the risks and vulnerabilities related to climate change in the coastal tourism sector, and for identifying effective, coherent adaptation strategies fully integrated with regional and local planning instruments. The outcomes of the participatory process carried out by the TTI are therefore an integral part of the contents of the SRACC for coastal tourism in this document.



2. CLIMATE CHANGE IN SARDINIA

This chapter provides a general overview regarding the context of climate change at the regional level. It summarizes existing policies and strategies within the scope of regional-scale climate planning and presents a framework aimed at comprehensively describing the current situation of the Sardinia Region in relation to climate hazards, associated impacts, and ongoing and anticipated change scenarios.

2.1 MAIN PLANS AND STRATEGIES FRAMEWORK

The Autonomous Region of Sardinia approved the **Regional Strategy for Climate Change Adaptation**¹ (SRACC) in 2019, with a subsequent update and expansion of the strategy in 2024. Moreover, in 2023, the **Regional Strategic Tourism Plan**² (STP) was adopted, which sets out a strategic framework document for the period 2023-2025. Consequently, the documents form the baseline and the conceptual and methodological framework within which this plan is situated. This paper sets out the intention to proceed with the identification of integrated lines of implementation specifically aimed at the adaptation of coastal tourism to climate change, starting from the above-mentioned documents.

The Regional Strategy for Adaptation to Climate Change (SRACC) provides a wealth of information on the climate profile of Sardinia over the period 1981-2010, as well as studies on climate scenarios. Furthermore, it offers methodologies and instruments for identifying climate change adaptation objectives across diverse sectors.

At the strategic level, the Regional Strategy for Sustainable Development Sardegna2030³ (RSSD) is another pertinent reference document. The RSSD constitutes the regional reference framework for environmental and territorial planning, programming and evaluation processes. The Strategy, which localizes the 2030 Agenda to the regional level, identifies objectives, lines of intervention, actions and targets for a sustainable development pathway that includes energy transition actions for the decarbonisation of the economy and towards a model of economy, protection of biodiversity and strengthening the resilience of ecosystems; interventions to strengthen the culture of sustainability and responsible consumption, to name but a few. Within this Strategy, Objective 7 aims to 'Achieve sustainable tourism for socio-economic development and the protection of culture and biodiversity', which is therefore capable of integrating the various dimensions of

¹ See SRAAC document at this link <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://portal.sardegna.sira.it/documents/21213/201290/SRACC2024.pdf/88c09cce-a7fa-407a-8edb-aeb310f6a6a1>

² See STP document here <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://delibere.regione.sardegna.it/protected/68798/0/def/ref/DBR68454/>

³ See Sardegna2030 <https://delibere.regione.sardegna.it/protected/57126/0/def/ref/DBR57095/>



sustainability, integrating the environmental and ecotourism aspects with the social and inclusion aspects, since the sector is considered an important lever for territorial enhancement, economic growth and territorial cohesion.

Sardegna2030 incorporates adaptation to climate change as a fundamental, cross-cutting principle, which is operationalised throughout:

- integration of climate change considerations into multi-level programming and planning;
- enhancement of surveillance and warning systems;
- management of the effects of climate change in diverse policy domains;
- augmentation of the adaptive capacity of the regional system.

At the planning level, reference documents include the Regional Landscape Plan, the Hydrogeological Structure Plan and its implementation rules, the Regional Plan of the Tourist Port Network (currently undergoing SEA - Strategic Environmental Assessment), and the Water Protection Plan. These documents are all highly relevant for the purposes of this Plan, but the integration of climate considerations is still in its infancy. In the implementation of the SRACC, dedicated working tables are being established to address this specific objective.

The region does not have coastal planning but only cognitive tools such as the Coastal Action Programme (PAC), dated 2013, which gives a description of the Sardinian coastline, identifying low, medium and high criticality stretches. This tool is used as a reference for planning coastal defence interventions.

Within the framework of the Interreg Euro Med project 'POSBEMED2', coordinated by Sardinia Region, it has been elaborated **a manual for conserving Mediterranean beaches with *posidonia oceanica* and assessing progress of management actions**⁴.

Considering the important ecological role of posidonia meadows for the marine ecosystem and of posidonia banquette in terms of barrier to coastal erosion, the project and the manual contribute to the dissemination of good shoreline management practices. In particular, it enables a long-term, balanced perspective of coastal management including climate change issues and the use of nature-based approaches, and promotes public understanding of Posidonia coastal areas and

⁴ See this document here <https://iucn.org/resources/grey-literature/manual-conserving-mediterranean-posidonia-beaches-and-assessing-progress>



proposed management approaches with consultation and participation of stakeholders.

It is important to note here that the project involved the regional administration and two protected areas (Penisola del Sinis - Isola di Mal di Ventre MPA and Capo Carbonara MPA).

Sardinia recognises, with its own law, the deposits of beached posidonia on the coasts as a natural defence tool against coastal erosion and, at the same time, allows the removal of the same only from the coasts where they prevent the regular use of the beaches during the summer season, defining, as of 2016, the operating procedures. The two protected areas have carried out interesting experimental projects on the application of NBS to manage Posidonia beach-dune systems.

In relation to this last aspect, the Region is currently working on the preparation of the specification for the classification of beaches and the drafting of regional formal guidelines for writing the management plan for Posidonia on beaches. We are confident that the implementation of this tool will allow better beach management by identifying the best management methods on a case-by-case basis.

2.2 COLLECTION AND ANALYSIS OF HISTORICAL CLIMATE DATA

2.2.1 DESCRIPTION OF DATA COLLECTION METHODS

The climate database adopted by the Regional Strategy for Adaptation to Climate Change (SRACC) is based on the processing of the climatic data of Sardinia measured and registered by weather stations homogeneously spread in the island territory (constantly monitored by the Regional Agency for Environmental Protection - ARPAS) for the thirty-year period 1981-2010 and for the main meteorological variables. This was achieved through procedures for controlling and processing historical data series of temperature and precipitation.

The climate scenarios adopted in the SRACC to highlight the trends up to 2050 of the main climatic variables and the resulting climate indicators are those provided by the regional climate model COSMO-CLM of the CMCC Foundation - Euro-Mediterranean Center on Climate Change. Regarding future climate, data from climate projections were used, expressed through the expected potential variations under the RCP4.5 and RCP8.5 scenarios for the period 2021-2050 compared to the reference period 1981-2010, with a spatial resolution of a grid of 2x2 km. After careful evaluation of the scenarios, only the RCP4.5 scenario was considered, which foresees the implementation of mitigation policies in the future, while the worst-case scenario RCP8.5, which does not foresee any mitigation policy, was disregarded.

The work was structured in the following phases: processing the climatology of the main meteorological variables based on available data; defining the database of daily series, quality control, and homogeneity analysis; calculating climate normals;



interpolating the climatologies of the processed meteorological variables on a regular grid; comparing the interpolated climatology (from observations) and the synthetic climatology (numerically estimated) and correcting systematic errors in future temperature scenarios; calculating the climate normals for 1981-2010 and producing outputs: indices and indicators. On the regional website, maps of the main climatic variables and indicators are available, periodically updated at <https://portal.sardegna.sira.it/clima>.

The strategic sectors identified in the SRACC are as follows: coast and transitional environments, health and well-being in urban areas, infrastructure, water resources, forests, agriculture and livestock, hydrogeological instability, and fires. In defining action priorities, the involvement of stakeholders is essential. Therefore, at the regional level, for each strategic sector identified by the strategy, key stakeholders have been identified and interviewed.

To gather relevant information for assessing the adaptation capacity for each of the aforementioned sectors, the following categories of stakeholders were involved:

- Public entities: e.g., regional technical and political agencies, local administrations;
- Sector organizations;
- Economic operators;
- Research entities;
- Sector experts;
- Civil society actors.

With reference to the dataset, difficulties are recorded regarding the availability, quality, comparability, and continuity of the data. Some fundamental statistical data for the construction of adaptive capacity indicators are difficult to obtain and are not always available at different scales. Furthermore, the spatial resolution of climate scenarios does not allow for data to be available at the coastline due to the models used. For decision-making, the availability of data at the local scale is essential. A coordinated approach to the collection, production, storage, and processing of data would be necessary for a proper assessment of climate and environmental risks. Sector-specific data and related indicators are indeed crucial for measuring and monitoring risk factors, causes, and direct and indirect impacts related to various hazards, exposure, vulnerability, the extent of potential losses and damages concerning the population, ecosystems, and infrastructure. There is a lack of data regarding the impact of climate change on the health and well-being of the population, particularly concerning the generalized increase in temperatures and the frequency and intensity of heat waves. In reference to the tourism sector, particularly coastal beach tourism, there is no available data on sea-level rise and wave strength as there are insufficient monitoring systems in place. This issue affects the monitoring



of coastal erosion, which is currently analyzed mainly through site-specific case studies. Additionally, specific studies on the effects of climate change on the socio-economic and sectoral system of the region have not yet been developed.

2.2.2 STATE OF THE ART OF CLIMATE ACTION PLANNING AND ASSESSMENT

The SRACC provides methods and tools to ensure that climate considerations are integrated into regional and local sectoral policies. The Strategy outlines how to integrate climate change adaptation into plans, programs, and projects, serving as a guide in this regard.

According to the provisions of the SRACC and the SRSvS, all regional plans and programs must include the integration of aspects related to climate change adaptation and sustainable development, in order to pursue "climate-compatible development." However, identifying adaptation actions in sectoral plans and programs is the responsibility of the holder of each individual Plan. The SRACC has chosen the approach of mainstreaming climate change adaptation, pursued through the identification of specific actions in plans, programs, and projects.

Therefore, also with reference to the coastal tourism sector, starting from the involvement of stakeholders, it will be necessary to identify:

- the risks and main potential impacts due to climate change in the sector;
- sources of danger;
- elements of the system exposed to climate risk;
- sensitivity factors and adaptive capacity for determining the vulnerability of the system;
- objectives to be pursued, related to adaptation goals;
- actions to be implemented, appropriately classified based on their contribution to the regional adaptation process.

The capacity to adapt depends on the context, processes, and determining factors such as:

- - governance, institutions, and policies;
- - human capital;
- - technology and research;
- - social capital;
- - biophysical factors;
- - infrastructure;



- - economic factors;
- - attitude/flexibility.

2.2.3 ANALYSIS OF PAST EXTREME WEATHER EVENTS

The analysis of climate data for the reference period 1981-2010 showed a **general positive trend for temperatures, both in maximum and minimum values, and a slight overall decrease in the average annual precipitation total**, although this is not observable in all areas of the region. These trends have been represented through the calculation of appropriate indicators of climate extremes, which have allowed for the representation of the trend of heatwaves, drought periods (frequency and duration), and intense precipitation events. Such phenomena produce effects on natural and human systems, particularly on water resources and ecosystems.

Changes in the water cycle pose the risk of significant quantitative and qualitative changes in water resources, a reduction in water availability during the summer period, and alterations in chemical-physical, biological, and ecological parameters. Regarding ecosystems, the impact on biogeochemical cycles and biodiversity can lead to the loss of habitats and species, changes in distribution areas, and the compromise of functionality and ecosystem services.

These factors contribute to a decline in the quality of life for the population, an increase in health risks for citizens (excess mortality and morbidity, diseases, impact of infectious diseases), and greater exposure to risk factors such as landslides, floods, inundations, and fires. Finally, the increase in energy needs and potential impacts on economic activities are a source of stress on infrastructure and network systems.

Below is the list of indicators used in the SRACC and data for the reference period 1981-2010.

TABLE 1. INDICATORS USED IN THE SRACC (REFERENCE PERIOD 1981-2010)

Indicator	Unit	Description	min	max	mean	median	trend
Maximum temperature (Tmax)	°C	Maximum mean climatic temperature					↑
Minimum temperature (Tmin)	°C	Minimum mean climatic temperature					↑
Average temperature (Tmean)	°C	Maximum mean climatic temperature					↑
Maximum of maximum temperature (TXX)	°C	Maximum value of the maximum daily temperature	33,9	44,4	39,1	39,3	↑
Tropical nights (TR)	days	Number of days with a minimum daily temperature greater than 20°C					↑



Indicator	Unit	Description	min	max	mean	median	trend
Consecutive dry days (CDD)	days	Maximum number of consecutive days with daily precipitation less than 1 mm	44,8	88,7	61	61,2	↑↓
Heat waves (HW)	days	Number of days with a maximum daily temperature greater than 35°C					↑
Number of heat waves (HWN)	number	Number of heatwaves. A heat wave is identified by the exceeding, for at least 3 consecutive days, of the 90th percentile of maximum temperatures assessed over a moving window of 31 days in the 30-year reference period					↑
Cumulative precipitation on rainy days (PRCPTOT)	mm	Sum of daily precipitation for days with daily precipitation greater than or equal to 1 mm					↓
Days with heavy precipitation (R20)	days	Number of days with daily precipitation greater than 20 mm	3,4	15,2	8	7,8	↑
95th percentile of daily precipitation (PR95prctile)	mm	Value of daily precipitation associated with a probability level of not exceeding 95%, extracted from the sample of daily precipitation values greater than or equal to 1 mm	77,2	322,3	156,4	142,9	↑
Maximum daily precipitation (RX1DAY)	mm	Maximum daily precipitation value for days with daily precipitation greater than or equal to 1 mm	35,6	134,9	58	50,4	↑
Maximum precipitation in 5 days (RX5DAY)	mm/days	Maximum precipitation in 5 days	61,8	215,4	98	88,2	↑

The perception of the threats posed by climate change is strong in response to the occurrence of extreme weather events that cause direct damage. However, awareness and information regarding vulnerability, and therefore the prevention and adaptation measures to be adopted, are lacking.

The population groups most at risk are the elderly, children, and vulnerable individuals. Unemployed people and socially marginalized individuals, as well as those with lower incomes and less access to resources, are among the most susceptible to climate risks.



2.3 IDENTIFICATION OF VULNERABILITIES

2.3.1 EXPOSURE OF REGION TO CLIMATE HAZARDS

Local climate variability and the evaluation of future anomalies due to climate change resulted from the study of the climate situation in Sardinia for the thirty-year reference period 1981-2010 of Sardinian strategy.

Climate projections have highlighted how the region will be characterized in the future by a general increase in temperature values, a reduction in the amount of total annual precipitation, an increase in average sea level and a general increase in average sea temperature. Climatic extreme values both in temperature and precipitation events are expected in intensity and frequency, particularly leading to heavy precipitation, storms and floods, river floods, drought and heat waves. Impacts are expected also in coastal erosion, saline intrusion and watershed salinization processes, with biodiversity loss and reduction in crop production.

2.3.2 EXPOSURE OF TOURISM TO CLIMATE HAZARDS

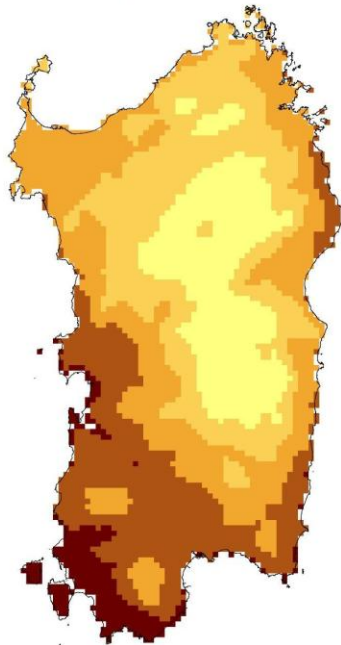
The tourism-related sectors, which are particularly vulnerable to climate hazards, include:

- the water-intensive production sectors (e.g., agriculture, energy) in relation to competitive use and the uneven spatial and temporal availability of water resources during the summer;
- fishing and aquaculture, due to changes in the structure of marine ecosystems caused by the combined effects of acidification, rising surface temperatures, and reduced oxygen content in the waters, leading to a decline in fish stock productivity;
- agriculture and livestock farming concerning the quality, quantity, and stability of production, the decrease in soil productivity and quality, the shifting of cultivation areas, and animal welfare;
- infrastructure and transportation, in relation to the increased demand for energy competing with the needs of the local population (e.g., for cooling environments and transportation means, etc.).

Future scenarios for Sardegna can be illustrated through spatial representations of the main climate change indicators (source SRACC).



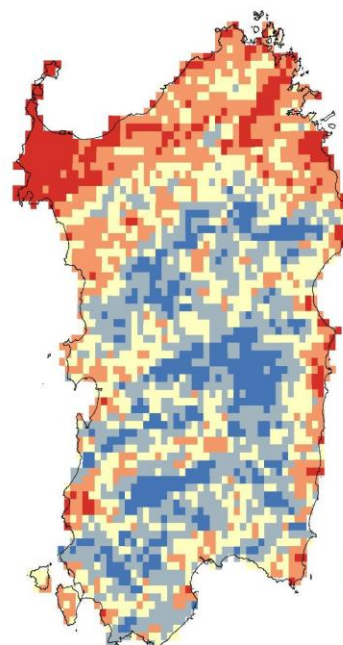
Consecutive dry days (CDD) 1981-2010



CDD (days)

44 - 53
54 - 59
60 - 65
66 - 71
72 - 86

Consecutive dry days (CDD) - Anomaly 2050 RCP 4.5

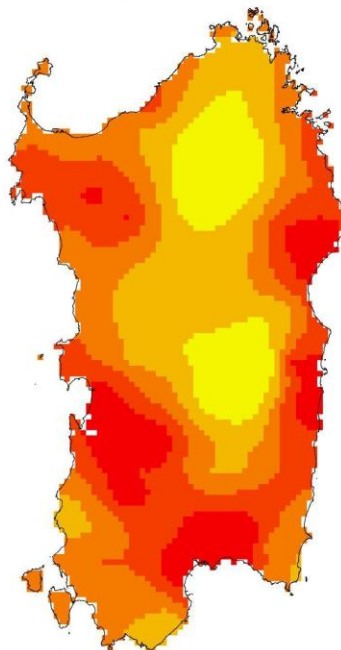


CDD Anomaly (days)

-10 - -4
-3 - -0,7
-0,6 - 3
4 - 7
8 - 20

FIGURE 3. MAP 1: CONSECUTIVE DRY DAYS 1981-2010; MAP 2: ANOMALY 2050 WITH RCP 4.5. SOURCE SRACC

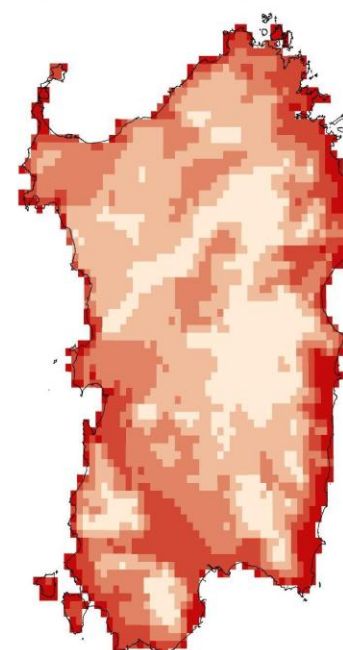
Tropical nights (TR) 1981-2010



TR (days)

7 - 16
17 - 23
24 - 29
30 - 35
36 - 47

Tropical nights (TR) - Anomaly 2050 RCP 4.5



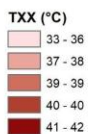
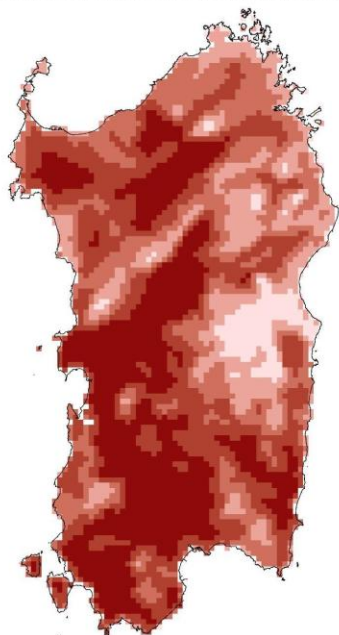
TR Anomaly (days)

6 - 13
14 - 16
17 - 20
21 - 25
26 - 32

FIGURE 4. MAP 1: TROPICAL NIGHTS 1981-2010. SOURCE SRACC; MAP 2: ANOMALY 2050 WITH RCP 4.5. SOURCE SRACC



Maximum of maximum temperature (TXX) 1981-2010



Maximum of maximum temperature (TXX) - Anomaly 2050 RCP 4.5

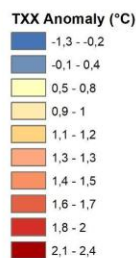
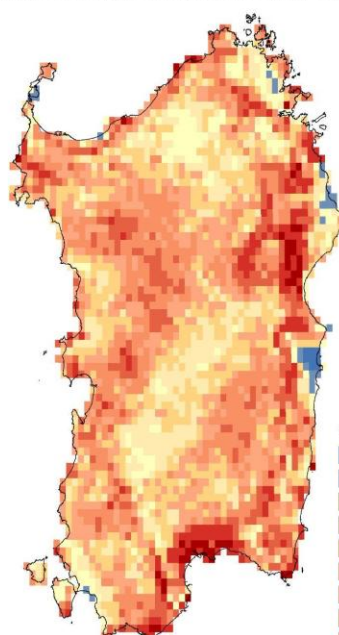
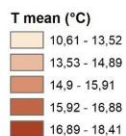
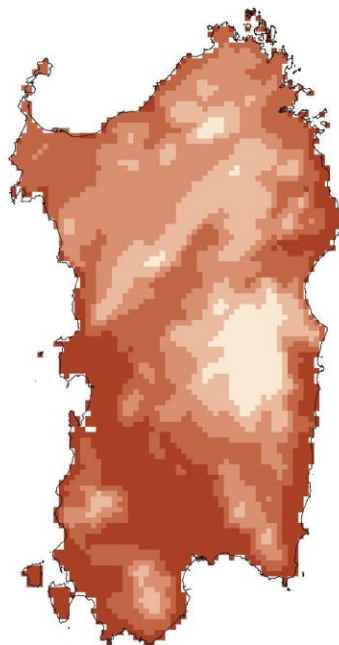


FIGURE 5. MAP 1: MAXIMUM OF MAXIMUM TEMPERATURE 1981-2010; MAP 2: ANOMALY 2050 WITH RCP 4.5. SOURCE SRACC

Maximum temperature (Tmax) 1981-2010



T mean Anomaly (°C) - Anomaly 2050 RCP 4.5

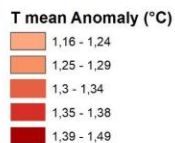
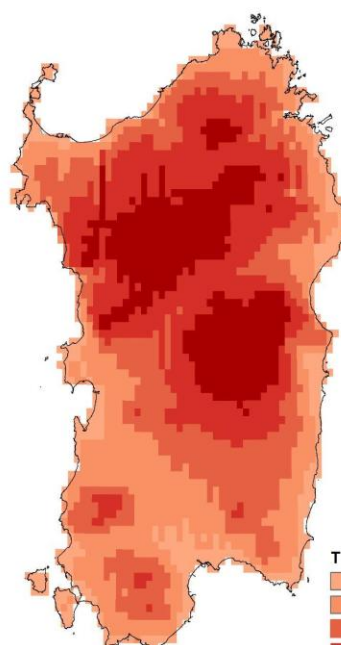


FIGURE 6. MAP 1: MAXIMUM TEMPERATURE 1981-2010; MAP 2: T MEAN ANOMALY 2050 WITH RCP 4.5. SOURCE SRACC

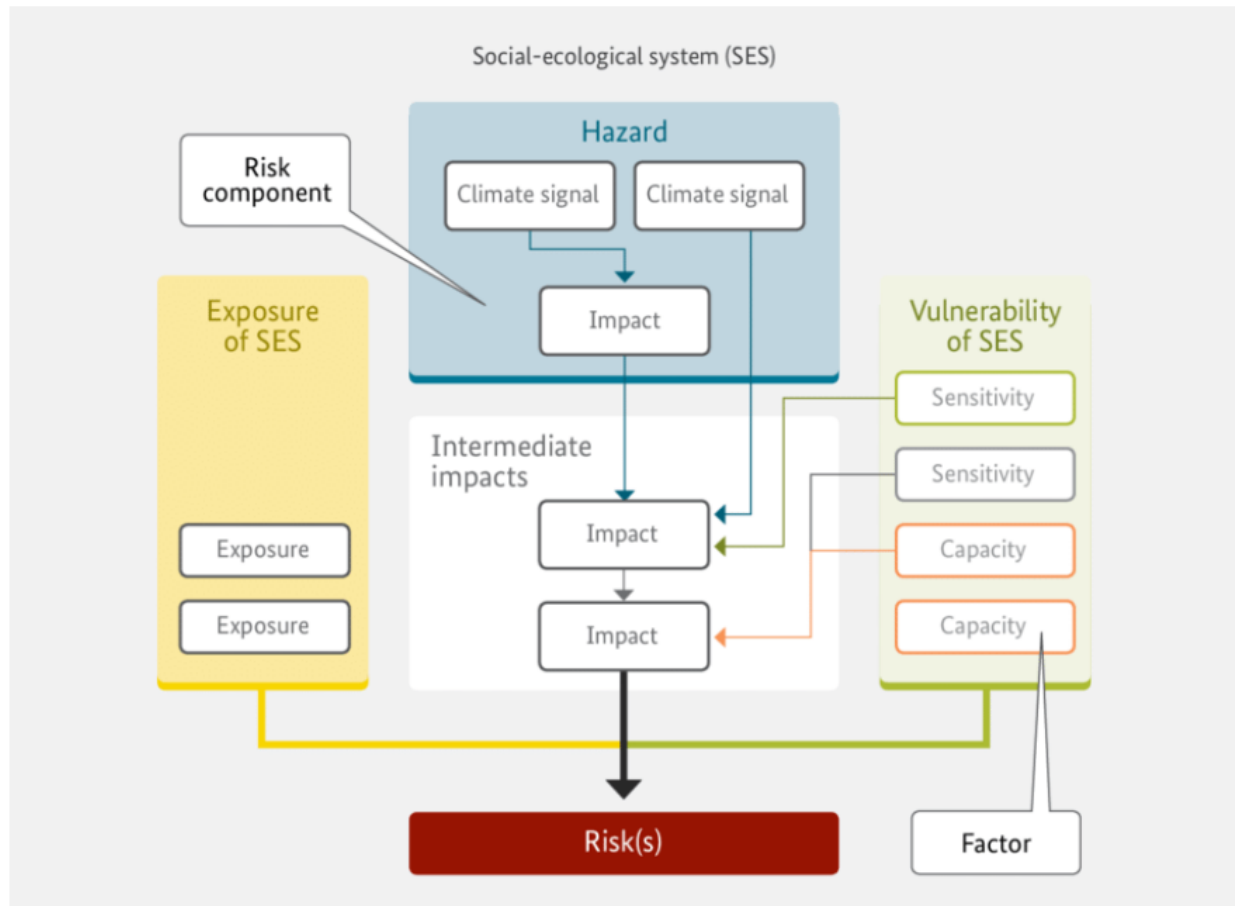


The Regional Strategy adopts Climate impact chains to define vulnerability, exposure to climate hazards and perturbations, sensitivity – adaptive capacity.

Through this method it is possible to:

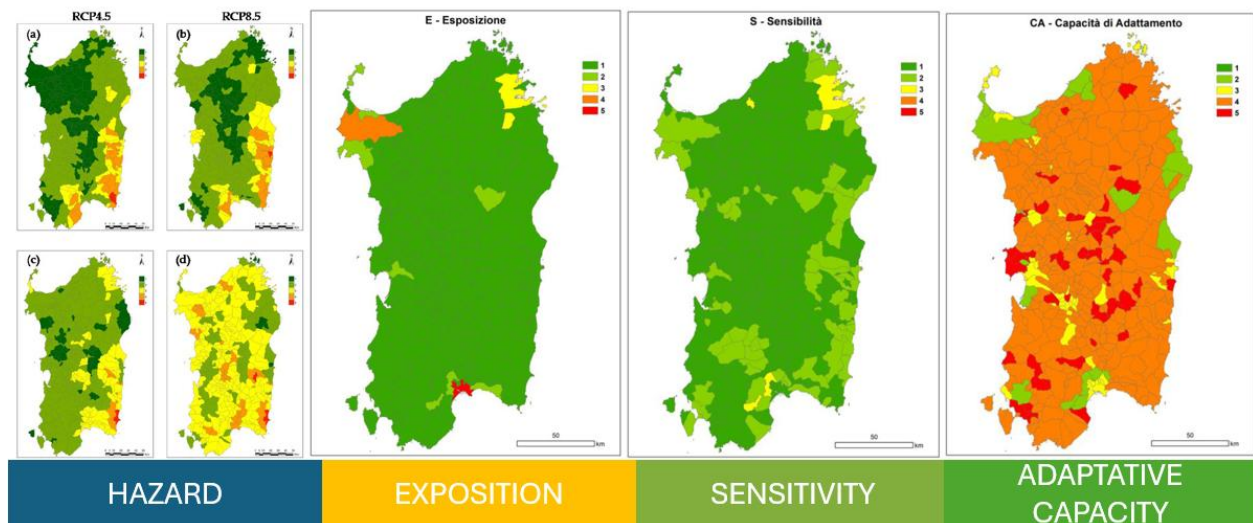
- Determine and project hazards and sensitivity
- Determine and project adaptive capacity
- Integrate and map vulnerability
- Identify, assess, and review adaptation operations

The method for creating vulnerability maps is shown below.



Structure and key elements of an impact chain (Source: GIZ and EURAC 2017)

FIGURE 7. STRUCTURE AND KEY ELEMENTS OF AN IMPACT CHAIN: SOURCE GIZ AND EURAC 2017



RISK OF FLOODING WITH LOSS OF HUMAN LIVES IN URBAN ENVIRONMENT

FIGURE 8. RISK OF FLOODING WITH LOSS OF HUMAN LIVES IN URBAN ENVIRONMENTS

2.3.3 ASSESSMENT OF CURRENT IMPACTS ON TOURISM

The tourism sector, with particular reference to coastal tourism, suffers direct effects with respect to unfavourable climatic conditions and indirect effects on the tourist attractiveness of destinations with reference to the modification of the current layout of the coastline, its habitats and the tourist activities and infrastructures that contribute to wellbeing and social subsistence with consequent variation and shifting of tourist flows and seasonality.

To date, among the potential specific impacts on coastal tourism we can indicate:

- beach erosion and damage to the coastline;
- damage to coastal infrastructures and safety risks;
- pollution and environmental degradation;
- alteration of local tourism traditions;
- reduction of outdoor activities;
- increase in costs for stakeholders in the production chain;
- sudden change in tourism preferences and cancellation of bookings;
- slowdown in coastal tourism growth.

Some of these impacts can be estimated and described from regional environmental measures and monitoring campaigns, some others derive from economical statistical



surveys and annual reports that will be incorporated in the Strategy. Further information will be pointed out in next phases of the project in the coming months.

2.3.4 FUTURE PROJECTIONS AND ANTICIPATED RISKS

The analysis of climate data and the outputs of climate models to 2050 have shown for the region:

- increase in temperatures;
- increase in the duration and frequency of heat waves
- increase in heat extremes
- reduction in the average annual precipitation accumulation;
- high intensity and frequency of extreme weather events;
- increase in the duration and frequency of drought periods

The main impacts attributable to the above-mentioned hazards can be summarised as follows

- hydrogeological instability;
- increase in mean sea level;
- increase in wave energy;
- coastal erosion;
- loss of ecosystem services;
- increase in mean sea temperature.



2.4 GENERAL RECOMMENDATIONS FOR THE CLIMATE ACTION PLAN

The reference tool for the identification of adaptation actions is the National Climate Change Adaptation Plan (PNACC, 2024) which contains the climate framework with sectoral impacts and vulnerabilities on a national scale, measures, actions and governance.

The PNACC, guides the development of climate change adaptation strategies and plans at regional and local scales by identifying for each sector the framework of adaptation measures and reference planning directions.

The database of sector actions identified by the PNACC for the tourism sector represented below constitutes the basic matrix of regional and local adaptation objectives to be declined and implemented for the tourism sector at the local scale.

PNACC Actions	Description
Diversification of the tourism offer	Integrates or replaces traditional tourist products (e.g., beach tourism, winter mountain tourism, etc.) with other proposals that can be attractive to tourists: wellness tourism, food and wine tourism, sports tourism, cultural landscape tourism, etc.
Destagionalization	Encourages tourists to shift their vacations to periods different from the traditional ones.
Monitoring and alert systems for extreme events in urban areas	Alerts people present in a given area (residents and tourists) in case of extreme weather events (especially heatwaves).
Monitoring systems for the sustainability (environmental, social, and economic) of the tourist destination	Detects and monitors the sustainability of tourism development in a destination from an environmental, social, and economic perspective and identifies any signs that may indicate a decline in tourism in the destination.
Conservation and reconstruction of coastal natural environments	Conservation and reconstruction of dunes and wetlands (ponds, lagoons, etc.), river renaturation, conservation of <i>Posidonia oceanica</i> , and proper planning of beach cleaning.
Reforestation of urban areas and the creation of green spaces within cities	Increase in urban areas designated for public green spaces.
Preservation of local agricultural crops and non-timber forest products through brands, labels, or image enhancement campaigns	Incentives, branding, labeling, and communication campaigns to enhance the image of typical Italian agriculture, differentiated according to regional specificities.



PNACC Actions	Description
Promotion of insurance policies for managing climate risks	Promotion of the use of insurance products and innovative financial products to reduce risks related to extreme weather events.



3. TOURISM IN SARDINIA

This chapter outlines a comprehensive overview of coastal tourism in Sardinia, integrating the analysis of current regional policies with the present trends and dynamics of the sector, and the relevant cognitive elements of coastal tourism in relation to resources, priority territorial attractions, and strategic services for competitiveness.

3.1 MAIN PLANS AND STRATEGIES FRAMEWORK

From a regulatory and political aspect, the main reference document for the development of tourism in Sardinia is the Regional Strategic Tourism Plan 2023-2025 (approved by DGR n. 47/2 of 29.12.2023), which serves as a reference point for strategic guidelines for the sector. Given that one of the region's primary attractions is its environmental and natural heritage, the Plan was formulated in accordance with the Regional Strategy for Sustainable Development - Sardinia 2030.

The document aims to develop an integrated tourism development strategy and to establish an ad hoc digital platform to create a sophisticated land monitoring system. Aspects of environmental sustainability constitute the so-called 'transversal axis of sustainability', in which many environmental issues are considered, although further clarification and evaluation is required regarding climate considerations. The plan was developed through the collaboration of 14 thematic tables, dedicated to collecting stakeholder needs and proposals from the public and private sectors. This included a specific table focused on "coastal-swimming and nautical tourism". We believe that this table can be a useful reference for the stakeholder involvement process for the purposes of the Tourism and Climate action plan for Sardinia.

The Regional Strategic Tourism Plan 2023-2025 identifies the 'Sardinia Tourist Platform' and the 'Sardinia Tourism Index' as one of the solutions deriving from the technological context. This tool collects data and indicators concerning various aspects of tourism (e.g. environmental impact, natural resource management) and allows for an objective assessment of the sustainability of the destination. This will help policy makers, operators and local communities to make informed decisions to improve tourism management in a way that is sustainable in the long term.

The 'Sardinia e-tourism index' was developed from the results of the research obtained with the creation of the SMAS protocol (©DUMAS-UNISS). If the index is parameterised to measure climate resilience, it could be used to assess how a destination is adapting to climate change.

3.2 REGIONAL CONTEXT AND SPECIFICITIES

Sardinia is the second-largest island in the Mediterranean Sea (after Sicily and before Cyprus) with an area of 24,100 KMq.



The coast of Sardinia is 1,849 km (1,149 mi) long. It is generally high and rocky, with long, relatively straight stretches, outstanding headlands, wide, deep bays, rias and inlets with various smaller islands.

The resident population in Sardinia, based on ISTAT data as of December 31, 2022, amounts to 1,578,146 residents, a decrease compared to 2021 (-9,267 individuals; -0.6%). More than half of the population lives in the provinces of Cagliari and Sassari. Women make up 50.9% of the resident population, surpassing men by over 29,000 units, mainly due to greater female longevity. The demographic data show a resident population with relatively high aging indices compared to Italy and a growing trend. This is coupled with a very low birth rate, which was 4.9 in 2022 and is continuously declining (-32% in the last decade). The foreign population in Sardinia, as of December 31, 2022, amounts to 50,211 people, approximately 3.2% of the resident population. 50.1% of the 377 Sardinian municipalities have a population between 1,001 and 5,000 inhabitants, and more than a quarter of the population (26.8%) resides there, while 17.1% of the population lives in the two municipalities with over 100,000 inhabitants, not exceeding a total of 300,000 units. Most Sardinian municipalities are in hilly or mountainous areas, with only a quarter being plain countries.

3.3 TOURISM IN SARDINIA

Sardinia is a destination of consolidated fame on the national and international tourism scene thanks to the existence of considerable resources of exceptional artistic, historical and archaeological value, alongside the inestimable environmental and landscape riches, mainly known for the great variety of enchanting beaches, which extend over 1851 km of coastline and are distinguished by the presence of crystal-clear waters and sands of high quality.

Tourism undoubtedly plays a fundamental role in the socio-economic framework of the Island and its evolution dates back to the 1960s-1970s, when, with the Costa Smeralda's entry into the international markets, Sardinia's image was established as a seaside and luxury destination, favoured by tourists from northern Europe.

This fact then contributed to the affirmation of a development model based mainly on coastal tourism, although over the years new formulas of enjoyment have been encouraged, based on the enhancement of other identity elements, the lengthening of the season and greater attention to environmental sustainability.

It should be pointed out that coastal tourism is developed through beach tourism and nautical tourism.

Beach tourism has as its main attraction the enjoyment of beaches and related recreational activities, e.g. bathing establishments, water sports such as windsurfing and kitesurfing, and others. The coastal areas that on average attract the most tourists are located in the north of the island, followed by the east coast, some locations in southern Sardinia and the west coast. This form of tourism is very widespread in areas characterised by sandy beaches and crystal-clear waters, and requires constant



updating of the offer in terms of attention to environmental impacts and also in terms of differentiating the activities that can be practised on the coasts, so as to be able to counteract the effects of seasonality and excessive crowding in the summer months, especially in renowned localities.

Nautical tourism, on the other hand, focuses on the use of the sea for recreational and leisure activities, such as sailing, cruising and yachting. The latter is particularly developed and concerns the use of private boats (yachts, sailboats, speedboats and dinghies) to explore the coasts, islands and inland waters. From an economic point of view, this activity is also associated with a considerable induced activity with economic activities focused on various sectors, e.g. beyond shipbuilding, those of clothing and nautical equipment, but also events and food supplies. Sardinia has a potential catchment area of 4.5 million people, and not only the number of registrations and nautical licences are growing, but also the number of foreigners who choose to practice this tourist activity in the region. As for the port system, this extends along the entire coastline of the island and consists of 54 equipped marinas and 56 roadsteads.

Returning to the development model based on coastal tourism, it should be noted that the formula continues, years later, to be preponderant, as shown by the most recent trend data.

In 2023, Sardinia consolidated its position as one of the most sought-after destinations at national and international level, recording a significant increase in tourist demand: admissions (number of nights) totalled 16.58 million (+ 2.4% over 2022) and arrivals reached 3.9 million, up 4.40% year-on-year, with an average stay of 4.25 nights. Attendances were equally distributed between Italians and foreigners, with a slight decrease on the part of Italians, who recorded a negative percentage variation of 2.34% in Sardinia compared to 2022 (Source: Regional Tourism Observatory).

Overnight stays in Sardinia - 2023 Total: 16.585.664

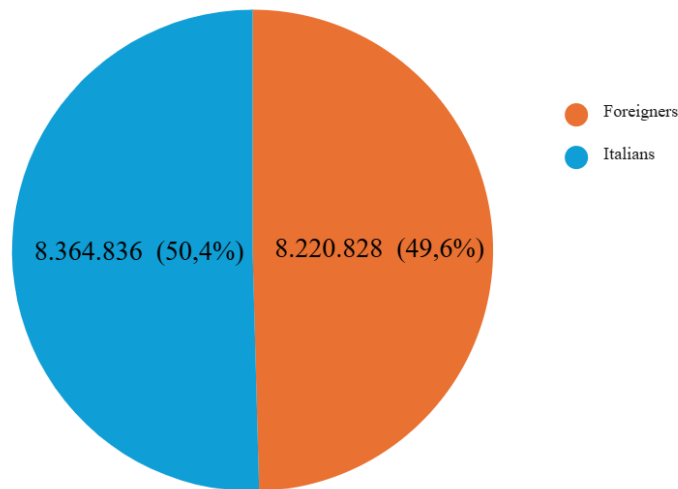


FIGURE 9. OVERNIGHT STAYS IN SARDINIA. SOURCE REGIONAL TOURISM OBSERVATORY 2023



The foreign tourists who most appreciate Sardinia come from European countries and are in order Germany (2.2 Mln), France (1.1 Mln) and Switzerland (0.87 Mln).

Among the non-European countries, the United States is growing steadily, with 0.22 Mln overnight stays recording a growth of 29% compared to 2022 (Source: Regional Tourism Observatory).

Overnight stays in Sardinia of foreign tourists by origin (in millions) - 2023

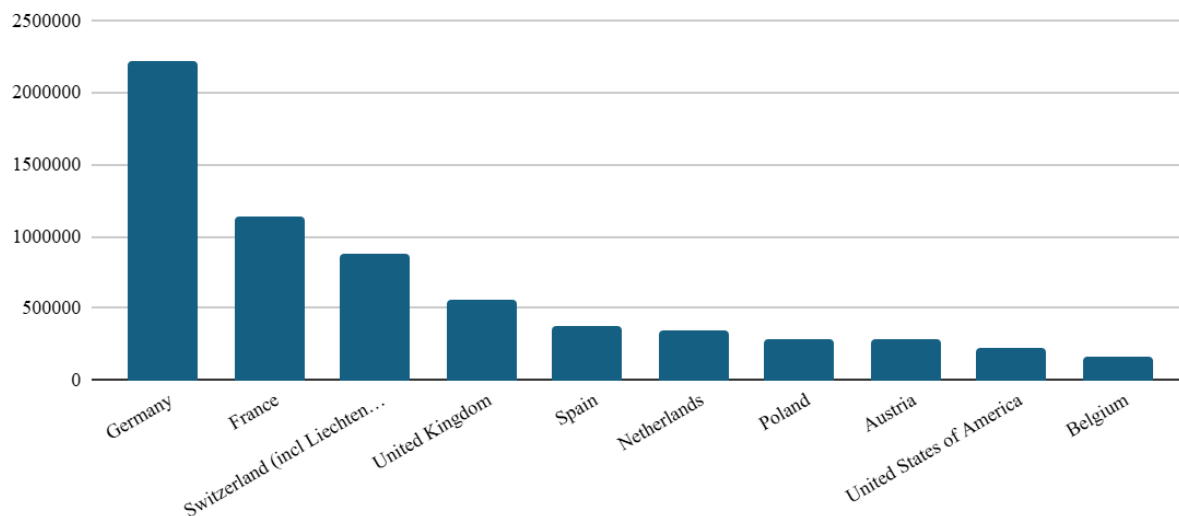


FIGURE 10. FOREIGN TOURIST OVERNIGHT STAYS IN SARDINIA. SOURCE REGIONAL TOURISM OBSERVATORY 2023

The distribution of overnight stays over the year shows a strong preference for sea-bathing tourism concentrated in the summer months, although in the so-called shoulder months steady growth has been consolidated due to favourable climatic conditions, a more accessible pricing policy, and the development of initiatives to promote alternative forms of tourism (e.g. active tourism), as shown in the graphs below:



Overnight stays per semester in Sardinia (in millions) - 2023

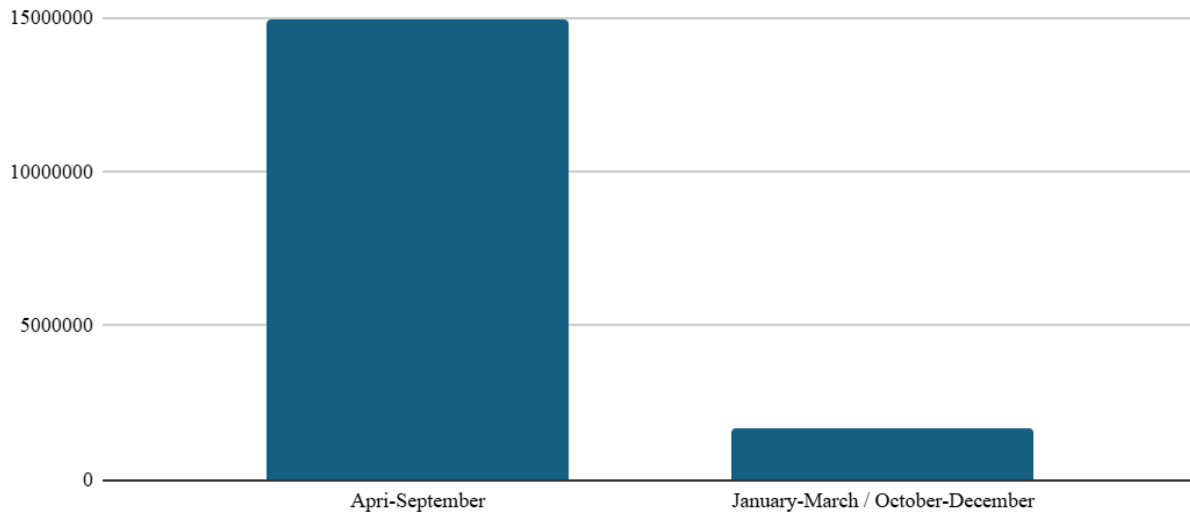


FIGURE 11. FOREIGN TOURISTS OVERNIGHT STAYS IN SARDINIA. SOURCE REGIONAL TOURISM OBSERVATORY 2023

Overnight stays per month in Sardinia (in millions) - 2023

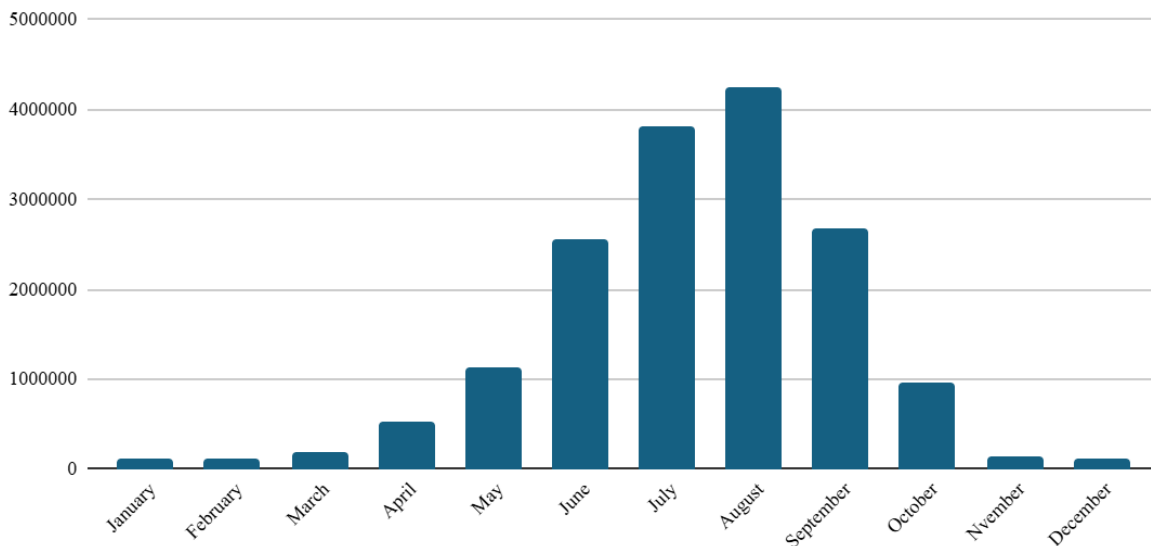


FIGURE 12. OVERNIGHT STAYS PER MONTH IN SARDINIA. SOURCE REGIONAL TOURISM OBSERVATORY 2023

To sum up, even in 2023, despite the efforts made by policy makers to lengthen the tourist season, enhance the attractions of the innermost areas, and optimise the effects of the advent of low-cost airlines and digital advances in holiday planning, the tourism sector in Sardinia continues to be characterised by a very pronounced seasonality and a consequent concentration of tourists (overnight stays) in coastal



areas, leading to situations of anthropic load and strong impact on the environment concerned.

According to the Sardinia Enterprise Report (Tourism Focus 2022), by the end of 2022, the tourism supply chain in the strict sense (which includes accommodation, restaurant services, travel agency services and tour operators) comprises 14,140 active businesses and 65,347 employees. Over the past five years, the Island has recorded a steady growth in active businesses. The presence of this sector in the Sardinian economy represents about 10% of the overall entrepreneurial fabric. This contribution is higher than the national average, which stands at 8%, placing Sardinia fourth among Italian regions for the incidence of the sector. In the restaurant field, which constitutes about 80% of tourism businesses, there has been a slight decrease in the number of companies. Fortunately, this negative trend has been offset by a 6.2% increase in the number of employees compared to 2021. The other two main sectors, however, are showing robust growth. Accommodation-related activities are rapidly approaching 2,000 businesses and employ over 13,000 people, recording an increase of 2,300 employees compared to the previous year. Tourist services, on the other hand, are experiencing growth in entrepreneurial initiatives and an increase in the number of employees exceeding 4%.

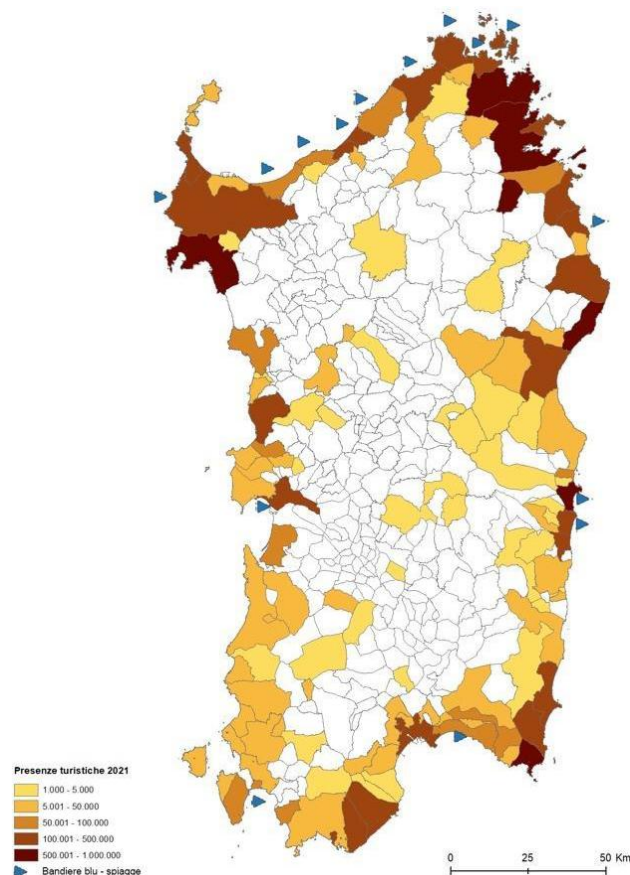


FIGURE 13. MAP 9. DISTRIBUTION OF OVERNIGHT STAYS IN 2021. SOURCE REGIONAL TOURISM OBSERVATORY

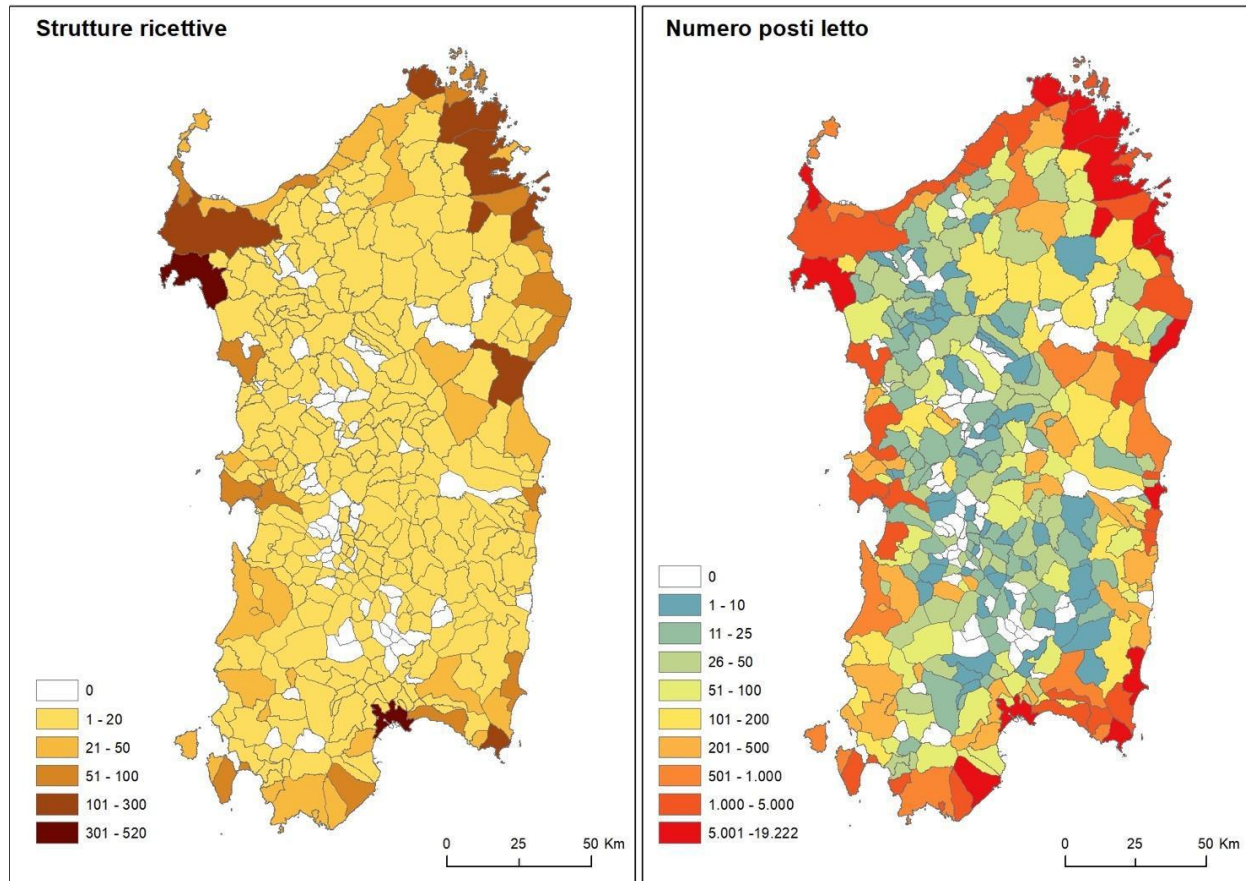


FIGURE 14. MAP 10: SPATIAL DISTRIBUTION OF TOURIST ACCOMMODATION. SOURCE REGIONAL TOURISM OBSERVATORY; MAP 11: DISTRIBUTION OF TOURIST ACCOMMODATIONS BY NUMBER OF BEDS. SOURCE REGIONAL TOURISM OBSERVATORY

We do not have data specifically related to the incoming movement of tourists. We have data regarding passenger traffic that has passed through the main ports and airports of Sardinia. According to the 'SardegnaMobilità' portal: using our 5 ports, in 2024, 2,621,074 people arrived in Sardinia, representing an increase of 4.5% compared to the previous year. Meanwhile, using one of our 3 airports, 5,109,416 people arrived in Sardinia. The following graph shows the monthly distribution of total passengers (arrivals and departures) for the year 2024. It clearly highlights the concentration during the summer months. We also recorded 684,061 cruise passengers in transit, an increase of 57.50% compared to 2023 (source: Port System Authority of the Sea of Sardinia).

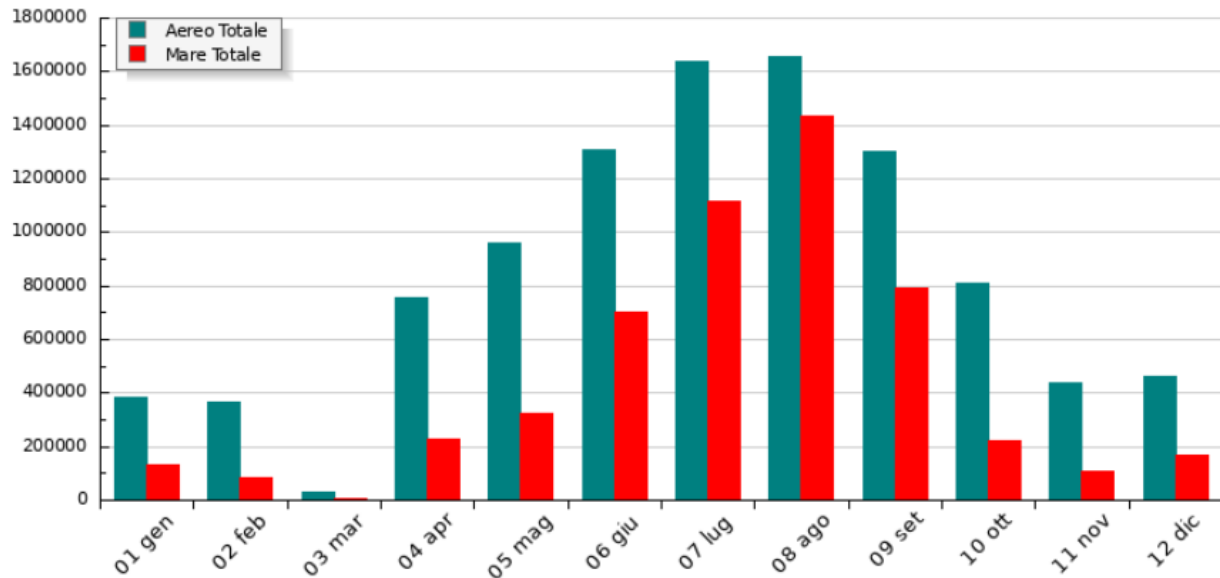


FIGURE 15. MONTHLY DISTRIBUTION OF TOTAL PASSENGERS (ARRIVALS AND DEPARTURES) FOR THE YEAR 2024, SOURCE. SARDEGNA MOBILITÀ

To sum up, the model of coastal tourism development, declined in its seaside and nautical components and extended also to the territories further inland and close to the coastal resorts themselves, determines a strong pressure, compromises sustainability and exposes the viability of the whole sector to environmental risks. The increasing intensification of the anthropogenic load therefore makes a change of course indispensable and requires the adoption of strategic policies and plans aimed not only at protecting the coastal environment, but also at responding to the challenges arising from climate change. An integrated approach that considers risks and promotes effective mitigation measures is essential to ensure a sustainable tourism future that preserves natural resources and, at the same time, promotes economic development without compromising its integrity. Protecting our coasts is, therefore, not only an ecological imperative, but also a necessity for the very survival and competitiveness of coastal tourism in the decades to come.

Tourism is one of Sardinia's largest economic sectors, acting as a significant generator of growth and employment in the island, while contributing to development and economic and social integration.

Sardinia policy aims to maintain Sardinia's status as a leading tourism destination, setting out a new strategy and action plan based on stimulating competitiveness in the sector, promoting the development of sustainable tourism and consolidating Sardinia's image as a high-quality destination.

It means promoting resilience and making tourism more environmentally friendly and implementing several ongoing legislative initiatives relating to environmental protection and climate neutrality.



3.4 TOURISM AND ENVIRONMENTAL IMPACT

Coastal seaside tourism is considered to be one of the main vectors of significant environmental pressures and impacts. The potential adverse effects of tourism development can be subsumed under numerous different impacts, but the reverse is also true: the tourism sector is being significantly affected by climate change.

The impact of tourism on Sardinia's environment is a multifaceted phenomenon, exhibiting both positive and negative aspects. The island, renowned for its striking landscapes, pristine waters, profound history and distinctive culture, draws millions of visitors annually. While tourism brings economic benefits, it also creates several environmental challenges such as:

The issue of **overcrowding and habitat destruction** is a pressing concern for popular tourist destinations, particularly those situated in coastal areas and the island's natural parks, which experience overcrowding during peak seasons. This phenomenon has the potential to result in the degradation of sensitive ecosystems, including dune systems, beaches, and marine environments. The construction of hotels, resorts, and infrastructure (such as roads) to accommodate tourists often encroaches on natural habitats, posing a threat to native plant and animal species.

The tourism industry produces a considerable amount of **waste**, including plastics, food waste, and litter, particularly during the peak season. This waste has the potential to pollute both terrestrial and marine environments, thereby causing harm to wildlife and ecosystems. This problem is further exacerbated in regions where inadequate waste management systems are in place, resulting in environmental contamination.

The rising volume of **traffic and transport** for tourists (cars, buses and boats) contributes to air pollution and carbon emissions. The presence of boats in Sardinia's pristine waters, particularly in popular areas such as the Maddalena Archipelago, poses a considerable threat to marine life and water quality in the Mediterranean.

There is a direct correlation between the increase in **water** demand (a vital resource) and the increase in tourist numbers. The excessive utilisation of water for hotels, restaurants, and leisure activities can exert pressure on local water supplies, particularly during the dry summer months. The demand for fresh water for irrigation in tourist-heavy areas also exerts a significant impact on the region's agricultural water systems.

Overfishing represents a further key concern, with tourism, particularly in coastal areas, often resulting in a rise in demand for seafood, thereby exerting pressure on local fish populations. The disruption of marine ecosystems resulting from overfishing can have a detrimental effect on biodiversity.



Biodiversity loss

Habitats, ecosystems and species are threatened by anthropogenic pressure. This is mainly represented by the construction sector, which aims to build tourist accommodation, infrastructure and facilities.

Although underestimated, tourists can also pose a threat by their own presence, causing disturbance to wildlife, including nesting sites for marine species such as sea turtles, e.g. nesting activities of *Caretta caretta*.

Human activities are also dangerous for the introduction of invasive species, and overexploitation of marine resources, such as overfishing and damage to marine life from diving tourism.

Soil: land degradation

Soil degradation in the region of Sardinia is an issue of considerable environmental concern. Despite low consumption compared to the national average, Sardinia suffers from a high risk of desertification, making land use even more critical.

The main causes of soil degradation in Sardinia have been identified as deforestation, overgrazing and poorly managed agricultural practices. These activities have resulted in a number of negative impacts, including soil erosion, loss of organic matter and reduced soil fertility.

According to the ISPRA-SNPA 2024 report, between 2022 and 2023, 462 hectares of soil were consumed in Sardinia, mainly due to infrastructure and industrial activities. Soil consumption occurs mainly through the conversion of natural or agricultural areas into artificial surfaces, often sealed with cement or asphalt. Although Sardinia has a low population density, this phenomenon is increasing and is monitored by ARPAS, the Regional Agency for Environmental Protection⁵.

One of the most evident effects of degradation is the loss of green areas: all over the island there is an increase in concrete at the expense of biodiversity and soil quality. For example, the municipality of Uta has seen an increase of 106 hectares of soil consumed in a single year, followed by Porto Torres (+36 hectares) and Olbia (+31 hectares). Sardinia is also the region with the largest degraded surface area in absolute terms, with 641,000 hectares of soil that have lost productivity, economic value and biodiversity, increasing vulnerability to hydrological phenomena.

Although Sardinia is one of the regions with the lowest population density in Italy (about 68 inhabitants per km², compared to a national average of about 200), it has experienced an increase in land consumption in coastal and urban areas. Sardinia has a lower consumption than the northern Italian regions, but higher than other less urbanised southern regions.

⁵ Source: <https://www.sardegnaambiente.it/>



The consumption rate is lower than the national average, but still increasing, particularly in the provinces of Cagliari, Sassari and Olbia-Tempio.

The coasts and urban areas are the most affected due to the expansion of tourism and the construction of new infrastructure.

Moreover, Sardinia has been experiencing a decline in green areas due to deforestation, wildfires, and land-use changes. The island has seen a notable loss of tree cover over the years, with key drivers including agricultural expansion, urbanization, and climate change-related factors such as prolonged droughts and heat waves⁶.

Sardinia has a high (around 19% of terrestrial and marine area) percentage of protected areas and Natura 2000 which limits urban expansion compared to other Italian regions. Infact, the Natura 2000 network - which is a European Union initiative for biodiversity conservation - consists of a large number of protected areas. Specifically, the region has a total of 128 sites designated under this network. These include 31 Special Protection Areas (SPAs), which are focused on protecting birds, and 89 Special Areas of Conservation (SAC), which aim to preserve critical habitats. Additionally, there are 8 Sites of Community Interest (SCI) awaiting final approval⁷.

Furthermore, a significant proportion of the island of Sardinia is covered by Natura 2000 areas. A considerable number of these areas also overlap with other forms of protected areas, including national and regional parks, as well as nature reserves and marine protected areas. These latter areas also represent an important spotlight in terms of sustainable tourism experiences.

Water pollution and scarcity

Increased demand for freshwater resources, leading to depletion of local aquifers. Pollution from untreated sewage, chemicals and plastic waste affecting coastal ecosystems. Eutrophication from agricultural and tourism run-off leading to algal blooms.

Air pollution

Greenhouse gas emissions from increased transport, including air travel, cruise ships and vehicles. Increased energy consumption in resorts and tourism facilities, often dependent on fossil fuels. Air quality degradation from increased vehicle emissions and construction dust.

⁶ Source: <https://www.globalforestwatch.org/dashboards/country/ITA/14/>

⁷ Source: <https://portal.sardegnasira.it/rete-natura-2000-dati-ambientali>,
<https://natura2000.eea.europa.eu/>



Coastal and marine degradation

Damage to marine ecosystems from boating, anchoring and underwater recreational activities. Beach erosion caused by poor land-use planning and unregulated development. Waste generated by tourists, particularly plastic and non-biodegradable materials.

Risk management and governance of natural disasters in Sardinia

The contribution analyzes the governance mechanisms for natural disaster risk in Sardinia, placing them within the broader Italian national context and the dynamics of climate change affecting the Mediterranean basin. Starting from a literature review on disaster risk governance, the research examines the Italian regulatory and institutional framework regarding risk management, and then focuses on the regional policies adopted by Sardinia.

According to Legambiente's Città Clima Observatory (Legambiente, n.d.), since 2017 Sardinia has recorded a sharp increase in damage resulting from various extreme weather events. With 75 events recorded since 2010, Sardinia ranks 13th at the national level.

The map highlights the main areas affected by the Cleopatra cyclone (2013), in particular Gallura and central-northern Sardinia (Olbia-Nuoro-Oristano); the areas affected by wildfires between 2020 and 2024, with particular attention to the Montiferru event (2021); and the regions that showed signs of forest "browning" in 2024, in particular Sulcis-Sarabus-Ogliastra.

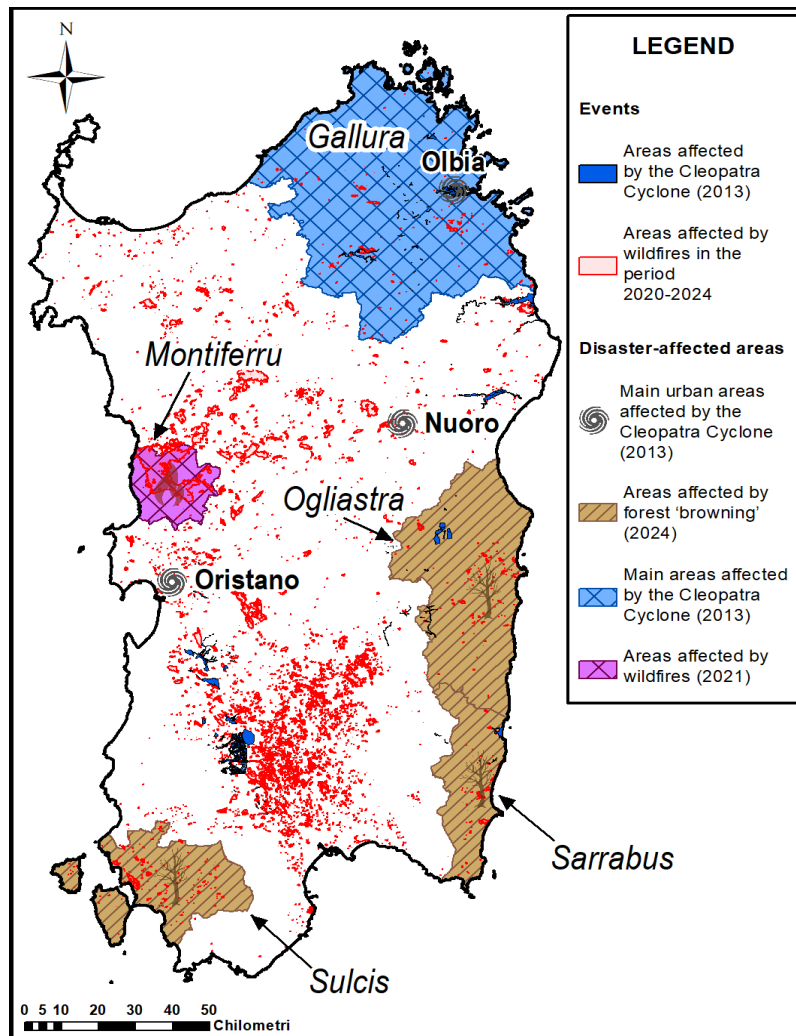


FIGURE 16. DISASTER-AFFECTED AREAS OF SARDINIA



4. CLIMATE RISK ON TOURISM IN COASTAL AREAS

This chapter analyzes the main critical issues of coastal tourism in relation to climate risks and the need for adaptation to climate change, highlighting the mutual interactions between tourism activities and the coastal environment.

The involvement of the directly interested public sectors, with a general cognitive framework shared during the participatory process, has created the conditions for identifying the specific impacts in the coastal tourism sector, the main elements directly affected, and the resulting risks they are exposed to.

This chapter therefore presents a synthesis of the climate risk assessment for coastal tourism, developed through joint work with the various Departments, based on the systematization of information and content from the knowledge framework outlined in the first two chapters, as well as discussions held during participatory activities.

4.1 THE PARTICIPATORY PROCESS

4.1.1 PHASES AND TIMELINE

As mentioned in the introduction, the development of this Strategy was accompanied by a participatory process carried out within the activities of the Regional Interdepartmental Technical Committee (TTI).

The activities of the process were divided into several phases, for a total of 6 meetings, interspersed with two stages dedicated to drafting the Strategy document (the draft and the final version):

- **Process launch (PHASE 0)**, dedicated to the presentation and introduction of activities involving all Departments;
- **In-depth analysis of scenarios, hazards, and impacts (PHASE 1)**, aimed at identifying specific risks for coastal tourism in relation to existing climate hazards, exploring potential impacts and exposed elements; this phase also aims to increase knowledge and awareness among the stakeholders involved and serves as a preparatory step for subsequent phases;
- **Identification of interventions, measures, and guidelines (PHASE 2)**, focused on exploring interventions and measures to be implemented in response to the identified risks and defining specific planning guidelines;

Drafting of the Strategy draft

- **Strategy refinement (PHASE 3)**, aimed at improving the draft of the SRACC document for coastal tourism through discussion and the collection of additional



contributions to be integrated, including the possible involvement of external stakeholders beyond the TTI;

Drafting of the final Strategy

- **Final public presentation event** of the SRACC for coastal tourism.

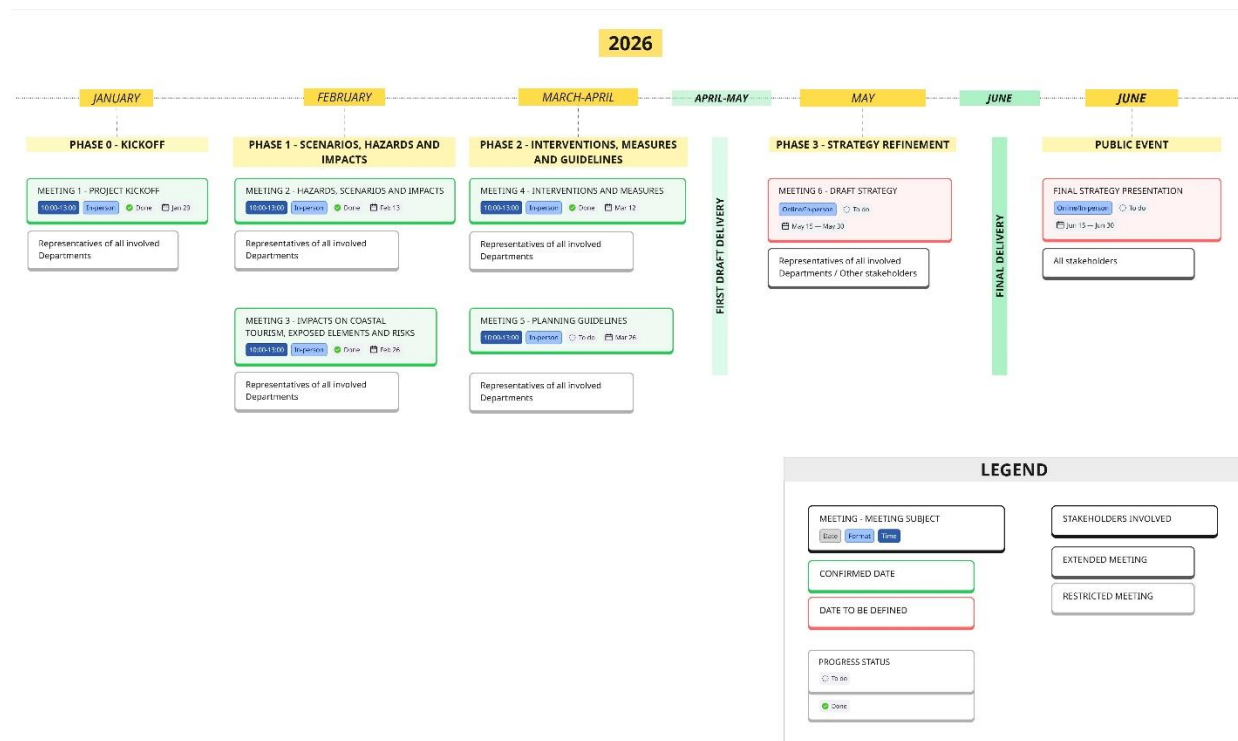


FIGURE 17. TIMETABLE OF THE PARTICIPATORY PROCESS ACTIVITIES

The process, launched in 2026, has completed its first phase, which led to the definition of the overall risk framework for coastal tourism, through the use of Impact Chains. The contents of these are summarized in the following paragraphs.

In particular, 3 meetings were held.

Meeting 1 – January 29, 2026

The meeting aimed to:

- Present the reference framework of the Regional Climate Change Adaptation Strategy (SRACC) and the NT4CC project;
- Present the planned activity schedule and the objectives of the participatory process;
- Initiate discussion on key topics of interest through the presentation of initial technical content, with contributions from climate change experts.



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Meeting 2 – February 13, 2026

The meeting aimed to:

- Present current scenarios through insights from tourism and coastal impact experts. On the tourism side, a contextual analysis of coastal tourism was provided as a qualitative-quantitative framework of the main dimensions of tourism processes relevant to the spatial context under consideration; on the environmental side, climate change-related hazards in coastal areas were illustrated, linking them to the most significant natural and anthropogenic processes;
- Develop a shared vocabulary and introduce the basic concepts of Impact Chains, as well as understand their methodology through practical examples in different contexts;
- Initiate discussion and begin identifying climate change impacts and exposed elements affecting coastal tourism.





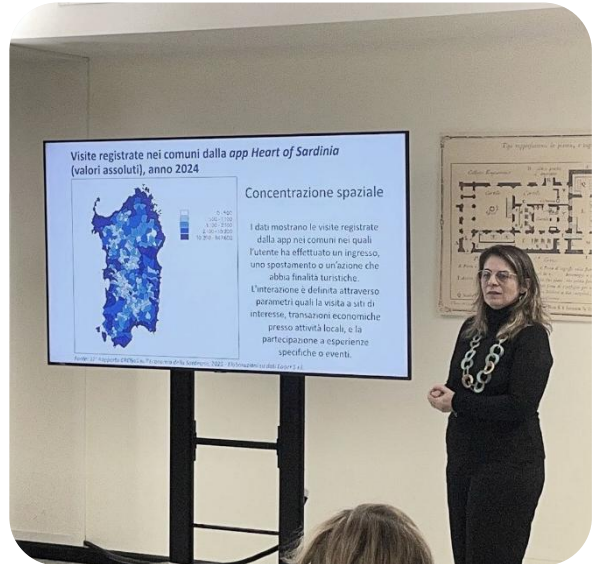
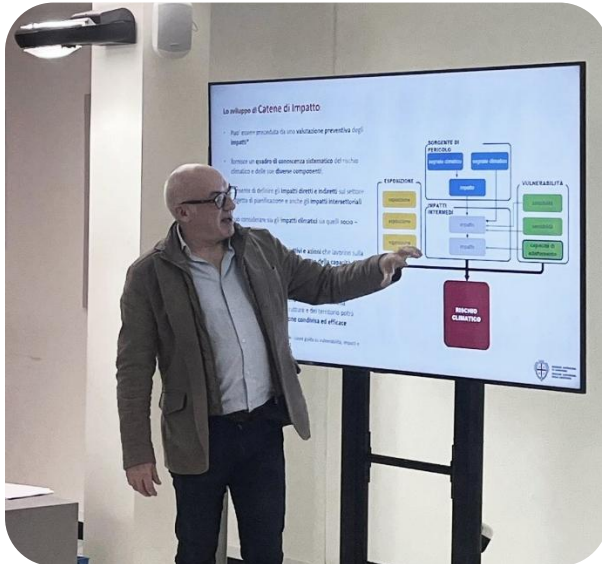
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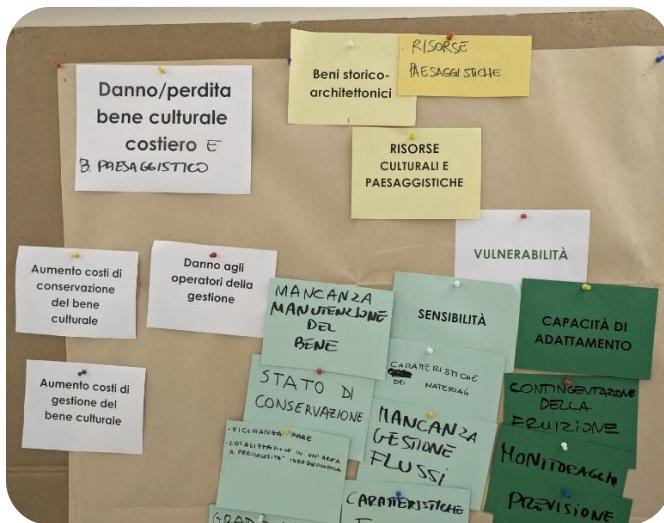
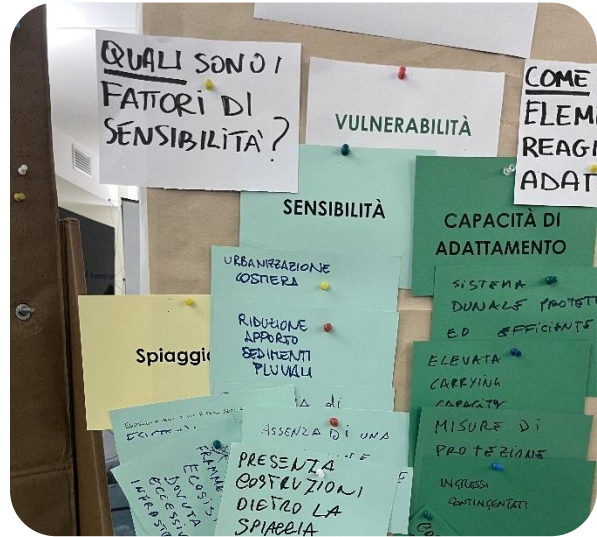
Meeting 3 – February 26, 2026

The meeting aimed to:

- Share an initial framework of the impact chains developed for the regional context. Three Impact Chains were developed based on the main exposed elements of coastal tourism: 1. Environmental resources, 2. Historical, cultural, and landscape resources, 3. Tourism services;
- Further develop these Impact Chains to define vulnerabilities and risks.

In particular, during this meeting, participants were divided into three groups based on expertise; each group was assigned one of the three impact chains to discuss specific impacts, sensitivities, adaptive capacity, and risks, based on the identified exposed elements.







4.2 RISK ASSESSMENT

4.2.1 IMPACT CHAINS: THE METHODOLOGY

Climate Impact Chains (ICs) are visual tools that link climate hazards (e.g., heatwaves) to specific risks (e.g., health risks), through the analysis of vulnerability and exposure. They are used to support risk management and adaptation, as they help to understand cascading effects on ecosystems and society, thereby facilitating informed decision-making. They represent both a conceptual model and an analytical tool to support decision-making processes. This methodology was applied during the participatory process to build a shared representation of the relationships among the components of climate risk: hazard, vulnerability, and exposure..

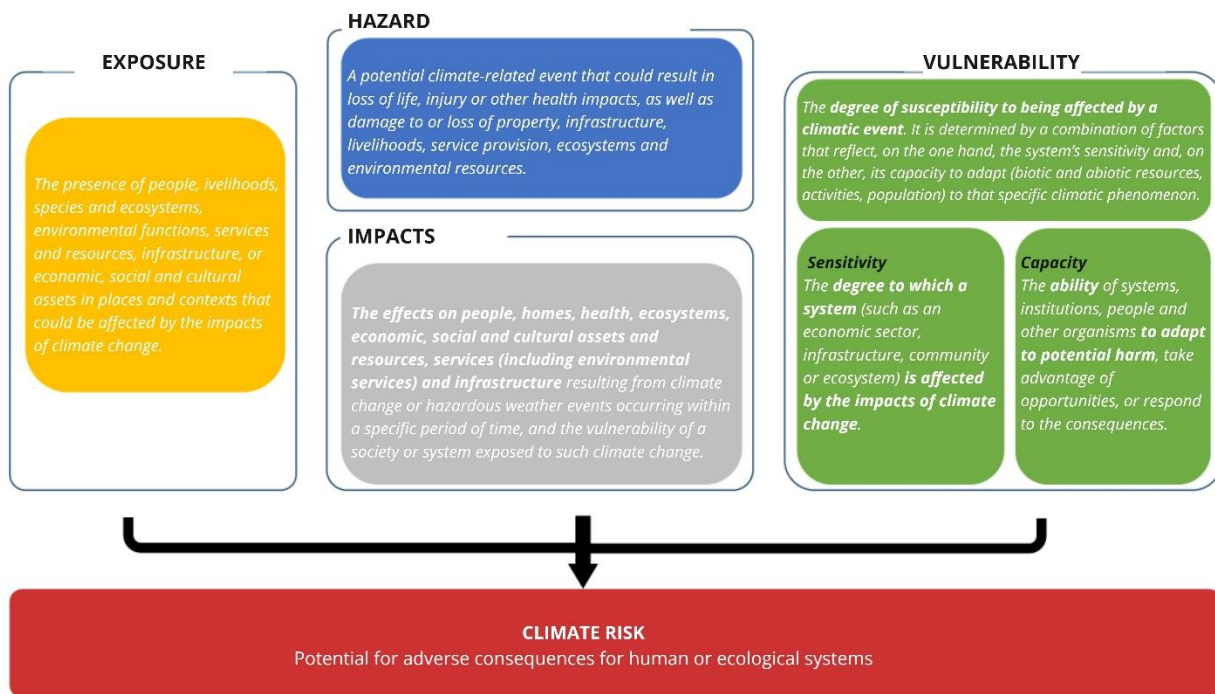


FIGURE 18. GLOSSARY OF THE COMPONENTS OF THE IMPACT CHAIN

Impact Chains also incorporate the concepts of climate drivers and non-climate drivers. A **climate driver** is defined as a “natural or human-induced element that directly alters the Earth’s energy balance, thereby modifying the climate (temperature, precipitation, etc.)” (examples include greenhouse gases such as CO₂ and methane emitted by human activities, and variations in solar radiation). A **non-climate driver** is defined as a “factor, often linked to human activities or socio-economic processes, that influences the environment, ecosystems, or society independently of climate variations” (examples include urbanization, deforestation, soil and water pollution, and land-use changes such as the conversion of forests into agricultural land).



These latter drivers are recognized as particularly relevant factors for coastal tourism, as they act as vectors of significant environmental pressures and impacts. The potential negative effects of tourism development can be traced back to a wide range of impacts and contribute to increasing overall risk levels.

Within the scope of this work, the focus is primarily on how the tourism sector is affected by climate change. The opposite perspective is addressed transversally; in fact, non-climate drivers are interpreted through vulnerabilities, as they influence the sensitivity of the context.

4.2.2 CONTENTS OF THE ASSESSMENT

The following section presents the outcomes of the process that identified the main components of the Impact Chain: hazards, impacts, vulnerabilities (sensitivity/adaptive capacity) of exposed elements, and risks. This knowledge base constitutes a shared reference framework for planning future regional policies and interventions.

HAZARDS.

Based on the contents identified at the regional level (Chapter 2), the hazards most relevant to the coastal sector were selected and examined in depth. These hazards include:

- Storm surges and coastal flooding
- Coastal erosion
- Groundwater salinization
- Landslides
- Floods
- Wildfires
- Drought
- Heatwaves
- Temperature increase and sea acidification
- Increasing unpredictability of weather and climate conditions

To simplify the analysis and foster an integrated reading of the phenomena, the identified hazards have been grouped and categorized into the following main categories:

- Extreme marine weather events
- Sea-level rise



- Extreme events due to precipitation
- Temperature increase
- CO₂ increase
- Climate unpredictability

The categorization of hazards was carried out as shown in the figure, in order to subsequently represent in a simplified form, the correlations between the different hazards and the main impacts affecting the coastal area.

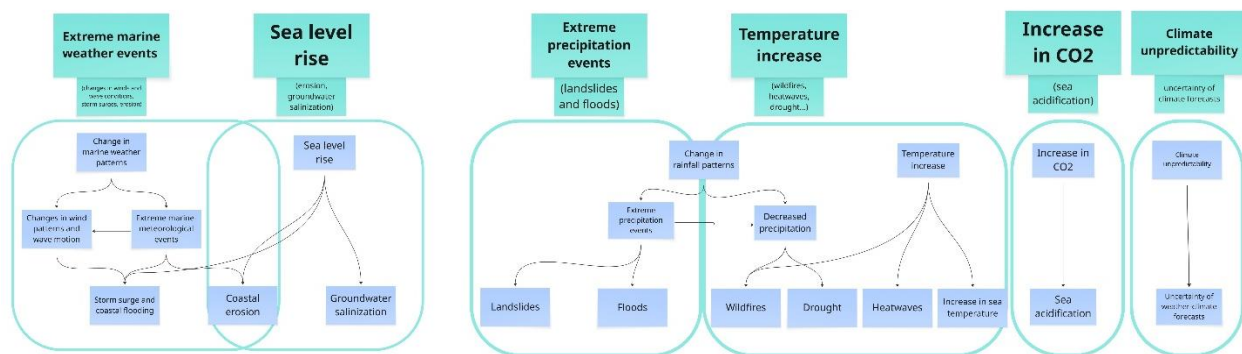


FIGURE 19. OVERVIEW OF THE MAIN CLIMATE HAZARDS AFFECTING THE COASTAL SECTOR

IMPACTS / EXPOSED ELEMENTS.

In relation to the territorial scope examined, the impacts can particularly concern:

- **Existing resources and assets** in the coastal sector, both of an environmental and historical-cultural nature (for example, with potential damage or loss of the asset itself and a consequent loss of attractiveness of the tourism-related resources);
- **Tourism services and businesses**, regarding everything related to the economic impact connected to the potential transformations of the coastal area, its functioning, and its components;
- **The population**, understood as the tourist population and seasonal workers, particularly in relation to the issue of health and, in the case of tourists, the possible deterioration of the overall tourist experience.

VULNERABILITY.

Once the potential impacts generated by the hazards on the identified and prioritized exposed elements were identified, the vulnerability assessment was conducted. The identified vulnerabilities therefore represent a synthesis between the sensitivity levels and the adaptive capacities of the analyzed exposed elements, providing a comprehensive framework useful for understanding the coastal system's predisposition to negative impacts deriving from climate change.



4.3 IMPACT CHAINS BY COMPETITIVENESS FACTOR

Based on the gathered information, impact chains for the identified resource categories were elaborated in order to describe the relationships between hazards, vulnerabilities, and expected impacts on the coastal system.

In particular, three Impact Chains were developed based on the main elements presented for tourism in the coastal area: 1 - Environmental resources, 2 - Historical-cultural and landscape resources, 3 - Tourist services.

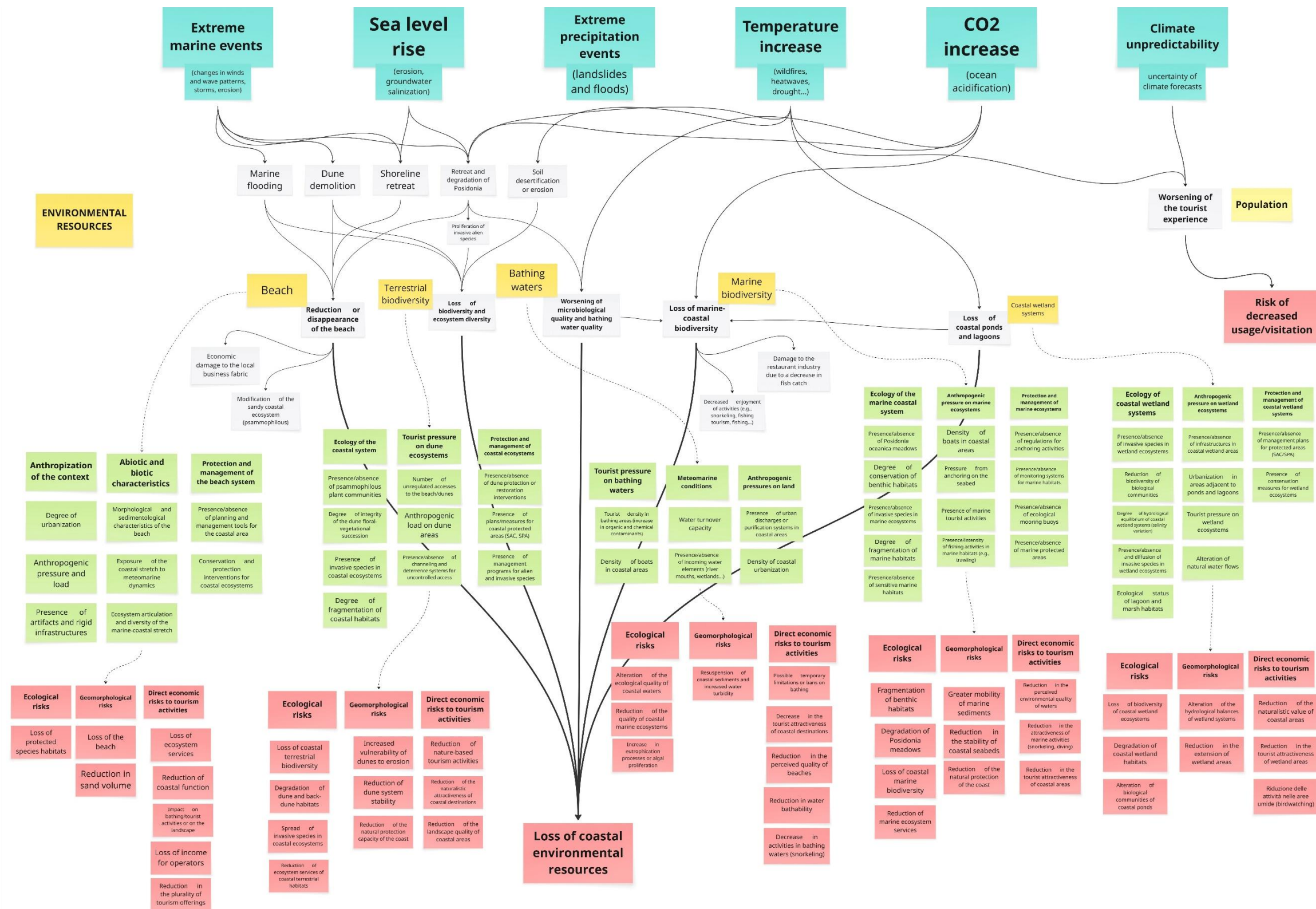


FIGURE 20. IMPACT CHAIN 1 – ENVIRONMENTAL RESOURCES



IMPACT CHAIN 1 – ENVIRONMENTAL RESOURCES

The identified exposed elements:

- Beach
- Terrestrial biodiversity
- Bathing waters
- Marine biodiversity
- Coastal wetland systems
- Population

The identified main impacts:

- Reduction or disappearance of the beach
- Loss of biodiversity and ecosystem diversity
- Worsening of microbiological quality and bathing water quality
- Loss of marine-coastal biodiversity
- Loss of coastal ponds and lagoons
- Worsening of the tourist experience

The identified secondary impacts:

- Marine flooding
- Dune demolition
- Shoreline retreat
- Retreat and degradation of Posidonia
- Soil desertification or erosion
- Proliferation of invasive alien species
- Economic damage to the local business fabric
- Modification of the sandy coastal ecosystem (psammophilous)
- Damage to the restaurant industry due to a decrease in fish catch
- Decreased enjoyment of activities (e.g., snorkeling, fishing tourism, fishing...)



The vulnerabilities identified in relation to the exposed elements:

Exposed elements: Beach

Anthropization of the context

- Degree of urbanization
- Anthropogenic pressure and load
- Presence of artifacts and rigid infrastructures

Abiotic and biotic characteristics

- Morphological and sedimentological characteristics of the beach
- Exposure of the coastal stretch to meteomarine dynamics
- Ecosystem articulation and diversity of the marine-coastal stretch

Protection and management of the beach system

- Presence/absence of planning and management tools for the coastal area
- Conservation and protection interventions for coastal ecosystems

Exposed elements: Terrestrial biodiversity

Ecology of the coastal system

- Presence/absence of psammophilous plant communities
- Degree of integrity of the dune floral-vegetational succession
- Presence of invasive species in coastal ecosystems
- Degree of fragmentation of coastal habitats

Tourist pressure on dune ecosystems

- Number of unregulated accesses to the beach/dunes
- Anthropogenic load on dune areas
- Presence/absence of channeling and deterrence systems for uncontrolled access (walkways, fences, ...)

Protection and management of coastal ecosystems

- Presence/absence of dune protection or restoration interventions
- Presence of plans/measures for coastal protected areas (SAC, SPA)
- Presence of management programs for alien and invasive species



Exposed elements: Bathing waters

Tourist pressure on bathing waters

- Tourist density in bathing areas (increase in organic and chemical contaminants)
- Density of boats in coastal areas

Meteomarine conditions

- Water turnover capacity
- Presence/absence of incoming water elements (river mouths, wetlands...)

Anthropogenic pressures on land

- Presence of urban discharges or purification systems in coastal areas
- Density of coastal urbanization

Exposed elements: Marine biodiversity

Ecology of the marine coastal system

- Presence/absence of Posidonia oceanica meadows
- Degree of conservation of benthic habitats
- Presence/absence of invasive species in marine ecosystems
- Degree of fragmentation of marine habitats
- Presence/absence of sensitive marine habitats

Anthropogenic pressure on marine ecosystems

- Density of boats in coastal areas
- Pressure from anchoring on the seabed
- Presence of marine tourist activities
- Presence/intensity of fishing activities in marine habitats (e.g., trawling)

Protection and management of marine ecosystems

- Presence/absence of regulations for anchoring activities
- Presence/absence of monitoring systems for marine habitats
- Presence/absence of ecological mooring buoys
- Presence/absence of marine protected areas



Exposed elements: Coastal wetland systems

Ecology of coastal wetland systems

- Presence/absence of invasive species in wetland ecosystems
- Reduction of biodiversity of biological communities
- Degree of hydrological equilibrium of coastal wetland systems (salinity variation)
- Presence/absence and diffusion of invasive species in wetland ecosystems
- Ecological status of lagoon and marsh habitats

Anthropogenic pressure on wetland ecosystems

- Presence/absence of infrastructures in coastal wetland areas
- Urbanization in areas adjacent to ponds and lagoons
- Tourist pressure on wetland ecosystems
- Alteration of natural water flows

Protection and management of coastal wetland systems

- Presence/absence of management plans for protected areas (SAC/SPA)
- Presence of conservation measures for wetland ecosystems

The identified risks are traced back to a single risk, named "Loss of coastal environmental resources", and are the following. These have been grouped into three risk categories for each exposed element: **ecological** risks, **geomorphological** risks and **direct economic** risks to tourism activities.

Exposed elements: Beach

Ecological risks

- Loss of protected species habitats

Geomorphological risks

- Loss of the beach
- Reduction in sand volume

Direct economic risks to tourism activities

- Loss of ecosystem services
- Reduction of coastal function



- Impact on bathing/tourist activities or on the landscape
- Loss of income for operators
- Reduction in the plurality of tourism offerings

Exposed elements: Terrestrial biodiversity

Ecological risks

- Loss of coastal terrestrial biodiversity
- Degradation of dune and back-dune habitats
- Spread of invasive species in coastal ecosystems
- Reduction of ecosystem services of coastal terrestrial habitats

Geomorphological risks

- Increased vulnerability of dunes to erosion
- Reduction of dune system stability
- Reduction of the natural protection capacity of the coast

Tourist-economic risks

- Reduction of nature-based tourism activities
- Reduction of the naturalistic attractiveness of coastal destinations
- Reduction of the landscape quality of coastal areas

Exposed elements: Bathing waters

Ecological risks

- Alteration of the ecological quality of coastal waters
- Reduction of the quality of coastal marine ecosystems
- Increase in eutrophication processes or algal proliferation

Geomorphological risks

- Resuspension of coastal sediments and increased water turbidity

Tourist-economic risks

- Possible temporary limitations or bans on bathing
- Decrease in the tourist attractiveness of coastal destinations
- Reduction in the perceived quality of beaches



- Reduction in water bathability
- Decrease in activities in bathing waters (snorkeling)

Exposed elements: Marine biodiversity

Ecological risks

- Fragmentation of benthic habitats
- Degradation of Posidonia meadows
- Loss of coastal marine biodiversity
- Reduction of marine ecosystem services

Geomorphological risks

- Greater mobility of marine sediments
- Reduction in the stability of coastal seabeds
- Reduction of the natural protection of the coast

Tourist-economic risks

- Reduction in the perceived environmental quality of waters
- Reduction in the attractiveness of marine activities (snorkeling, diving)
- Reduction in the tourist attractiveness of coastal areas

Exposed elements: Coastal wetland systems

Ecological risks

- Loss of biodiversity of coastal wetland ecosystems
- Degradation of coastal wetland habitats
- Alteration of biological communities of coastal ponds

Geomorphological risks

- Alteration of the hydrological balances of wetland systems
- Reduction in the extension of wetland areas

Tourist-economic risks

- Reduction of the naturalistic value of coastal areas
- Reduction in the tourist attractiveness of wetland areas
- Reduction of activities in wetland areas (birdwatching)

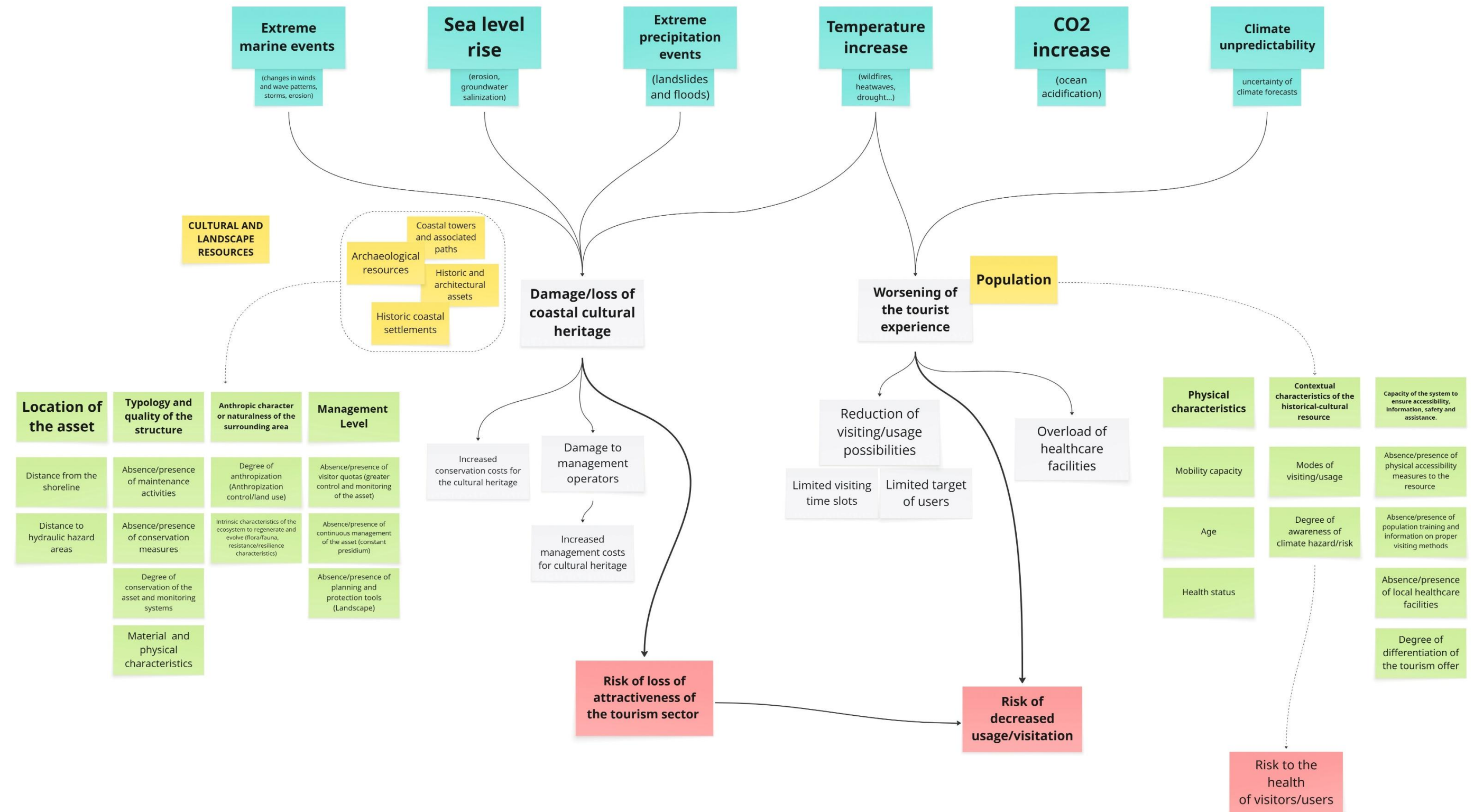


FIGURE 21. IMPACT CHAIN 2 – HISTORICAL-CULTURAL AND LANDSCAPE RESOURCES



IMPACT CHAIN 2 – HISTORICAL-CULTURAL AND LANDSCAPE RESOURCES

The identified exposed elements:

- Coastal towers and connected paths
- Archaeological resources
- Historical-architectural assets
- Historical coastal settlements
- Population

The identified main impacts:

- Damage/loss of coastal cultural heritage
- Worsening of the tourist experience

The identified secondary impacts:

- Increased conservation costs for cultural heritage
- Damage to management operators
- Increased management costs for cultural heritage
- Reduction of visiting/usage possibilities
- Limited visiting time slots
- Limited target of users
- Overload of healthcare facilities

The vulnerabilities identified in relation to the exposed elements:

Exposed elements: cultural and landscape resources

Location of the asset

- Distance from the shoreline
- Distance from hydraulic hazard areas

Typology and quality of the structure

- Absence/presence of maintenance activities
- Absence/presence of conservation measures
- Degree of conservation of the asset and monitoring systems
- Material and physical characteristics



Anthropogenic character or naturalness of the surrounding area (with particular reference to landscape assets)

- Degree of anthropization (Anthropization control/land use)
- Intrinsic characteristics of the ecosystem to regenerate and evolve (flora/fauna, resistance/resilience characteristics)

Management Level

- Absence/presence of visitor quotas (greater control and monitoring of the asset)
- Absence/presence of continuous management of the asset (constant presidium)
- Absence/presence of planning and protection tools (Landscape)

Exposed elements: population

Physical characteristics

- Mobility capacity
- Age
- Health status

Contextual characteristics of the historical-cultural resource

- Modes of visiting/usage
- Degree of awareness of the climate hazard/risk

Capacity of the system to ensure accessibility, information, safety, and assistance

- Absence/presence of physical accessibility measures to the resource
- Absence/presence of population training and information on proper visiting methods
- Absence/presence of local healthcare facilities
- Degree of differentiation of the tourism offer

The identified risks:

- Risk to the health of visitors/users
- Risk of loss of attractiveness of the tourism sector
- Risk of decreased usage/visitation

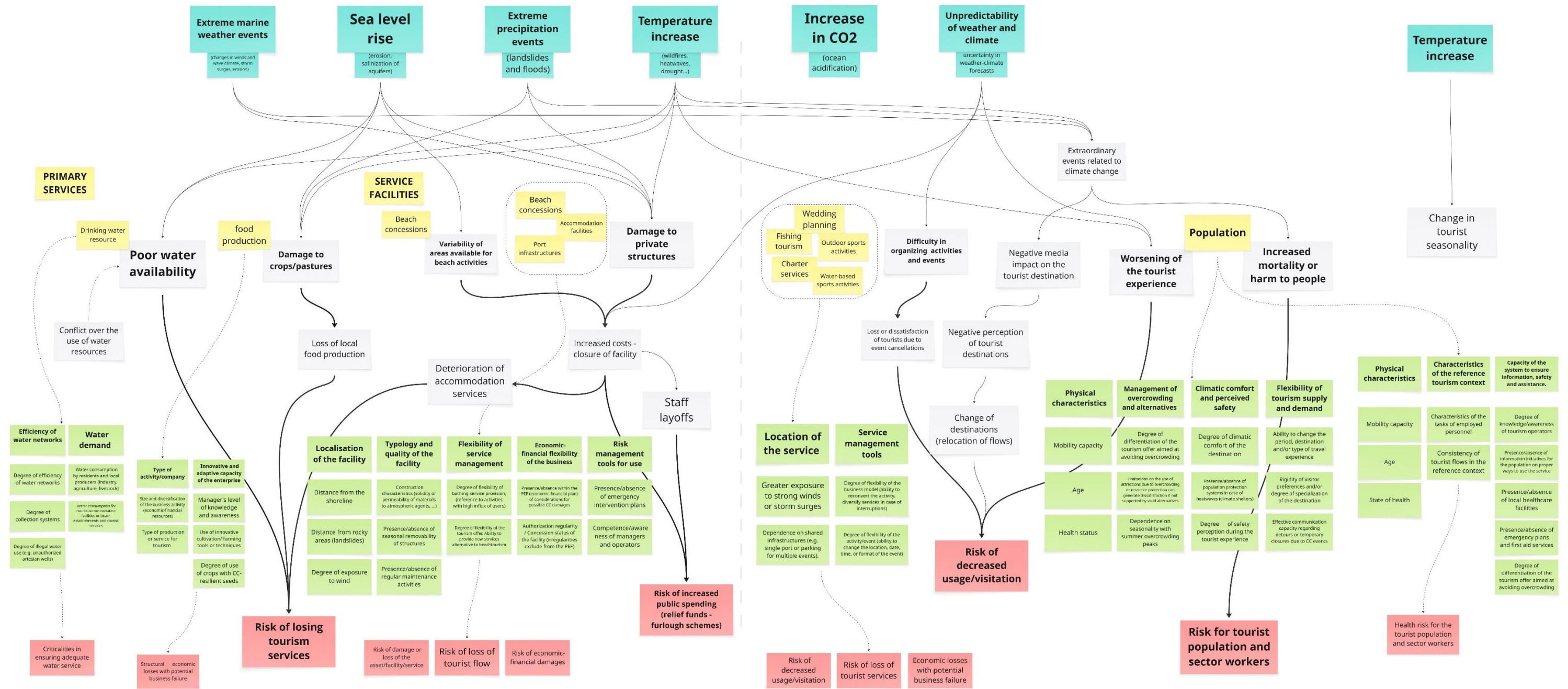


FIGURE 22. IMPACT CHAIN 3 – TOURIST SERVICES

IMPACT CHAIN 3 – TOURIST SERVICES

The identified exposed elements:

- Service facilities: beach concessions, accommodation facilities, port infrastructures
- Primary services: drinking water resources, food production
- Activities and events (e.g., wedding planning, fishing tourism, outdoor sports activities, charter services, sports activities related to the use of the sea)
- Population

The identified main impacts:

- Poor water availability
- Damage to crops/pastures
- Variability of areas available for beach activities
- Damage to private structures
- Difficulties in organizing activities and events
- Worsening of the tourist experience
- Increased mortality or harm to people

The identified secondary impacts:

- Conflict over the use of water resources
- Loss of local food production
- Worsening of accommodation services
- Increased costs - facility closure
- Staff layoffs
- Loss of or dissatisfaction from tourists due to event cancellations
- Negative media impact on the tourist destination
- Negative perception of tourist destinations
- Change of destinations (relocation of tourist flows)
- Change in tourism seasonality

The vulnerabilities identified in relation to the exposed elements:

Exposed elements: primary services

Efficiency of water networks

- Degree of efficiency of water networks

- Degree of collection systems
- Degree of illegal water use (e.g., unauthorized illegal artesian wells)

Water demand

- Water consumption by residents and local producers (industry, agriculture, livestock)
- Water consumption by tourist accommodation facilities or beach establishments and coastal services

Typology of activity/company

- Size and diversification of the business activity (economic-financial resources)
- Typology of production or service for tourism

Innovative and adaptive capacity of the enterprise

- Degree of knowledge and awareness of the manager
- Use of innovative farming/breeding tools or techniques
- Degree of use of crops with CC-resilient seeds

Exposed elements: service facilities

Location of the facility

- Distance from the shoreline
- Distance from rocky areas (landslides)
- Degree of exposure to wind

Typology and quality of the facility

- Construction characteristics (solidity or permeability of materials to atmospheric agents, ...)
- Presence/absence of seasonal removability of structures
- Presence/absence of regular maintenance activities

Flexibility of service management

- Degree of flexibility of beach services offered, with particular reference to activities characterized by a high influx of users
- Degree of flexibility of the tourism offer. Capacity to offer new alternative services to beach tourism

Economic-financial flexibility of the business

- Presence/absence within the PEF (economic-financial plan) of considerations for possible CC damages

- Authorization regularity / Concession status of the facility (irregularities exclude from the PEF)

Risk management tools for usage

- Presence/absence of emergency intervention plans
- Competence/awareness of managers and operators

Exposed elements: activities and events

Location of the service

- Greater exposure to strong winds or storm surges
- Dependence on shared infrastructures (e.g., single port or parking for multiple events)

Service management tools

- Degree of flexibility of the business model (ability to reconvert the activity, diversify services or markets in case of interruptions)
- Degree of flexibility of the activity/event (ability to change the location, date, time, or format of the event)

Exposed elements: population

Physical characteristics

- Mobility capacity
- Age
- Health status

Management of overcrowding and alternatives

- Degree of differentiation of the tourism offer aimed at avoiding overcrowding
- Presence/absence of limitations on the use of attractions due to overcrowding or resource protection (e.g., beaches) can generate dissatisfaction if not supported by valid tourist alternatives
- Dependence on seasonality with summer overcrowding peaks (e.g., bathing concentrated in July-August)

Climatic comfort and perceived safety

- Degree of climatic comfort of the destination
- Presence/absence of population protection systems in case of heatwaves (climate shelters)
- Degree of safety perception during the tourist experience

Flexibility of tourism supply and demand

- Ability to change the period, destination and/or type of travel experience
- Rigidity of visitor preferences and/or degree of specialization of the destination
- Effective communication capacity regarding detours or temporary closures due to CC events

Characteristics of the reference tourism context

- Characteristics of the tasks of employed personnel
- Consistency of tourist flows in the reference context

Capacity of the system to ensure information, safety, and assistance

- Degree of knowledge/awareness of tourism operators
- Presence/absence of training and information initiatives for the population on proper ways to use the service
- Presence/absence of local healthcare facilities
- Presence/absence of emergency plans and first aid services
- Degree of differentiation of the tourism offer aimed at avoiding overcrowding

The identified risks:

- Risk of losing tourism services
- Structural economic losses with potential business failure
- Criticalities in ensuring adequate water service
- Risk of damage or loss of the asset/facility/service
- Risk of economic-financial damages
- Risk of increased public spending (Relief funds-furlough schemes)
- Risk of decreased usage/visitation
- Health risk for the tourist population and sector workers
- Risk for tourist population and sector workers

5. STRATEGIC PLAN

The Strategic Plan, based on the discussion that emerged during the participatory meetings, identifies specific measures and guidelines designed to be implemented within regional planning and programming instruments, making the path towards greater climate resilience concrete.

The document aims to define a basic knowledge of available solutions, understood as measures and interventions potentially applicable in the reference contexts.

Starting from the definition of the operational objectives that emerged during the participatory process, moments of discussion and dissemination were initiated, aimed at sharing techniques and interventions based on innovative approaches, with particular attention to Nature-Based Solutions (NBS).

These solutions, aimed at strengthening the resilience of coastal ecosystems, are evaluated in relation to their effectiveness, adaptability, and consistency with the project's objectives, in order to identify those most suitable to be promoted within the scope of regional plans and programs.

In this perspective, starting from successfully implemented experiences, practical guidelines have been developed to encourage their more widespread and targeted use, adapting them to the specificities of the tourism sector in the coastal area.

The Strategy, therefore, defines the guidelines through which to implement the identified adaptation measures within the instruments under regional competence.

For each category of action, it will be possible to identify, in relation to the commitments undertaken, the entities responsible for implementation, the priorities, and the methods of integration into regional-level programming and planning documents.

6. ENABLING CONDITIONS

This report presents an assessment of the necessary conditions for the Region of Sardinia to implement its Regional Climate Change Adaptation Strategy for the coastal tourism sector, developed within the NaTour4CChange project. The enabling conditions for climate action implementation also concern aspects related to the process that accompanies the strategy's development, as the implementation takes shape starting from the preparatory activities carried out during the overall process. Therefore, the set of necessary conditions identified represents the comprehensive approach adopted to address the issue of climate change, the steps already activated, which are intended to be taken to ensure adequate operability of the instrument, and the steps to be planned to implement its dissemination and structural integration into regional and local operations. In summary, the identified key areas can be grouped into:

- governance;
- methodological approach;
- operability;
- supervision and monitoring;
- financing;
- dissemination.

Strong governance emerges as the most important factor, requiring the strengthening of technical skills, awareness, institutional capacity, and coordination among the Regional Departments in the context of climate change adaptation. The adopted methodological approach primarily involves several Regional Departments, making them active participants in the strategy's construction for the purpose of operational integration of the content into plans and programmes. Operability concerns the set of concrete measures to be implemented. Supervision and monitoring represent the safeguard for long-term implementation. Financing is a fundamental tool to ensure support for activities. Dissemination, on the other hand, aims to stimulate the motivation to act through communication and sharing.

6.1 ENABLING CONDITIONS

GOVERNANCE

With Resolution no. 14/71 of May 22, 2024, the Regional Government updated the Regional Climate Change Adaptation Strategy - SRACC (adopted in 2019 with Regional Government Resolution no. 6/50 of February 5, 2019), which aims to address the climate challenge by anticipating expected scenarios, mitigating effects, and implementing adaptation measures calibrated to the specific needs of the territories, in coherence with and in implementation of the Regional Strategy for Sustainable Development (Regional Government Resolution no. 39/56 of October 8, 2021). Furthermore, a well-structured governance is in place for the implementation of the SRACC, which identifies the following bodies: a) Institutional Steering Committee (Cabina di regia istituzionale), as the regional coordination structure for integration into the regional Administration's strategies and policies; b) Inter-departmental Working Group (Gruppo di lavoro interassessoriale - GdLI), composed of the Directorates-General whose competencies entail the adoption of climate change adaptation measures, which supports the Steering Committee; c) Thematic Working Groups (Tavoli tematici) which, activated within the GdLI's work, will act for a cross-sectoral integration of climate change adaptation at all levels and planning and programming sectors; d) Local Authorities of Sardinia, identified among the responsible actors for the implementation of the regional adaptation process by virtue of the fundamental role they play through the adoption of instruments within their competence, such as the PUC (Municipal Urban Plans) and PUL (Coastal Use Plans), in any programmatic documents adopted, such as the SEAPs/SECAPs (Sustainable Energy and Climate Action Plans), as well as in the effective and coherent management of the economic and financial instruments they benefit from.

The NaTour4CChange project is placed within this framework, and with Regional Government Resolution (DGR) 9/12 of February 12, 2025, the General Directorate for Environmental Protection, the General Directorate for Tourism, Craftsmanship and Commerce, the General Directorate for Local Authorities and Finance, and the General Directorate for Territorial Urban Planning and Building Supervision, are mandated to establish the Thematic Working Group for the development of the regional climate change adaptation strategy for the coastal sector. The Resolution also defines the task of the Working Group, which is to define orientations, guidelines, recommendations, and modalities for the integration of climate considerations into the instruments within their respective competence. This group constitutes the operational arm of the Inter-departmental Working Group supporting the Institutional Steering Committee for climate change adaptation. In the initial phase of the Technical Working Group, other Directorates-General requested to join: the General Directorate for Cultural Heritage and the General Directorate for Civil Protection. Therefore, at the moment, 6 Departments are involved, instead of the 2 initially planned by the project.

This element constitutes an enabling condition that creates good premises for the quality of the Strategy and its ability to influence the ongoing processes in the regional administration. The Climate Change Adaptation Strategy for coastal tourism involves competencies that are administratively distributed among numerous regional departments: it is therefore essential to keep the Regional

Thematic Working Group on climate change adaptation in the coastal sector active and operational, once the project is completed and the strategy is approved. Therefore, it is fundamental to identify administrative mechanisms and projects, characterized by technical-economic feasibility in the short and medium term, to ensure continuity.

METHODOLOGICAL APPROACH

It is important to build a method to ensure the continuous and structural implementation of climate action within regional Plans and Programs (P/P) and local operational instruments. Through the work of the Thematic Working Group, a methodological and strategic basis has been built for planning climate change adaptation for the coastal sector of the Region of Sardinia, also for the purpose of its integration into the Entity's various planning and programming instruments. Once the methodology is defined and shared, which is precisely that of an Inter-departmental Technical Working Group for constant discussion and construction, the activities are oriented towards defining, with policymakers and stakeholders, adaptation measures to counter the identified risks and vulnerabilities, and, over time, monitoring and adapting them. Another fundamental component of the methodological approach is the associated participatory process, which, on the one hand, allows for strengthening the awareness and skills of individuals – who themselves become drivers for more widespread dissemination within the regional technical structure – and, on the other hand, the shared work for the development of the SRACC around a specific theme, allows for defining operational guidelines, within the regional planning and programming instruments, that are more coherent and synergistic with each other.

OPERABILITY

The Strategy defines operational measures and guidelines for the implementation of the Regional Climate Change Adaptation Strategy for tourism in the coastal sector. The specific measures and guidelines designed to be integrated or applied directly within the programming instruments of the regional bodies are built in a shared manner with the Thematic Working Group, making the process of assimilation and implementation concrete. The process leading to the definition of measures and guidelines is based on a shared assessment of climate-related risks for the coastal area, starting from the background knowledge framework (climate scenarios, information and data on the processes analyzed, representation of significant case studies, ...) on hazards and impacts.

SUPERVISION AND MONITORING

It is important to ensure that the cross-sectoral guidelines and operational instruments developed by the Working Group are implemented and monitored. It is assumed that the defined guidelines will be implemented, as they are of mutual interest. The risk is that they may not be fully and coordinately implemented by the different Directorates-General. Furthermore, the impact must also be supervised. Methods must be defined to monitor the strategy's implementation over time and the progress in achieving the set objectives. In particular, monitoring must assess the effectiveness of the Action Plan, verifying the extent to which the

strategy's guidelines have been adopted and translated into concrete actions, as well as which further projects and initiatives can be activated by the Entities and Stakeholders involved in the implementation. Therefore, it is necessary to:

- plan monitoring measures;
- define operational tools and mechanisms that facilitate the implementation of the instruments and link them to sectoral laws.

FINANCING

To ensure that the Strategy is implemented, it is necessary to dedicate adequate financial resources to the planned interventions, through incentives and rewards for local authorities and the private sector. It is therefore necessary to identify possible specific financial sources for support, of European, national, and regional origin. In this regard, it is important to highlight that numerous financial sources are available. For example, almost 35% of the Sardinia ERDF OP 2021-2027 budget is dedicated to climate change.

DISSEMINATION

It is essential to maintain a high and effective level of communication based on climate data and the results of the policies undertaken, in order to stimulate the motivation to act. The level of attention and communication must be kept high, as the interventions planned by the Strategy, being transformative, require a high level of sharing and determination. If these conditions are not met, the entire strategy could be at risk. To activate and maintain a high level of interest and sharing, it is proposed to:

- carry out a cycle of workshops in the various relevant sectors (tourism, transport, agriculture, construction) to develop the theme, compare good practices, and enhance them;
- launch a communication and education campaign for low-environmental-impact tourism and attentive to extreme event alert systems (through the media, schools, and visitor centers);
- create incentives and recognition programs (e.g., green tourism awards, eco-certification grants) to motivate private sector participation.

6.2 CONCLUSION

In summary, the Mediterranean region, and Sardinia in particular, is facing the growing threat of climate change, which endangers its rich biodiversity and the vital coastal tourism sector. The Regional Coastal Tourism Adaptation Strategy constitutes the implementation and thematic articulation of the Regional Climate Change Adaptation Strategy (SRACC): having this instrument strengthens the political commitment of the NaTour4CChange project. Six key areas are identified for its effective implementation: governance, methodological approach, operability, supervision and monitoring, financing, and dissemination. Strong governance, which maintains active inter-departmental collaboration beyond the project's duration, emerges as the most critical enabling factor. Success also

depends on the ability to build a methodological approach that ensures the structural integration (constant and continuous over time) of climate action into regional Plans and Programs, the definition of concrete and shared operational measures, constant supervision and monitoring to evaluate their effectiveness, the guarantee of adequate financing, and a high level of dissemination and communication to stimulate the participation and motivation to act of all regional, local, and private actors.