NEVERMORE

New **E**nabling **V**isions and Tools for **E**nd-use**R**s and stakeholders thanks to a common **MO**deling app**R**oach towards a Climat**E** neutral and resilient society

D6.1 Report on NEVERMORE case studies characterization

August 2023

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101056858.

Document history

Project Acronym	**NEVERMORE**
Project ID	101056858
Project title	New Enabling Visions and Tools for End-useRs and stakeholders thanks to a common MOdeling appRoach towards a ClimatE neutral and resilient society
Project coordination	Fondazione Bruno Kessler (Italy)
Project duration	1st June 2022 – 31st May 2026
Deliverable Title	D6.1 Report on NEVERMORE case studies characterization
Type of Deliverable	R – Document, Report.
Dissemination level	PU – Public
Status	Final
Version	1.0
Work package	WP6 – Analysis of climate change impacts and risk at case studies
Lead beneficiary	CARTIF
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Due date of delivery	31/08/2023
Actual submission date	22/09/2023

Date	Version	Contributors	Comments
04/01/2023	0.1	Carla Rodríguez (CARTIF)	Table of Content (ToC)
23/01/2023	0.2	Carla Rodríguez (CARTIF)	Section 2.1 completed. Sections X.1.3 of each CS completed (from template gathered info from CS leaders and supporters)
27/03/2023	0.3	Iván Ramos (CARTIF)	Completion of section 2 and section 6 of the CS4 as example for the rest of CS's sections
03/05/2023	0.4	Iván Ramos, Carla Rodríguez (CARTIF)	Instructions for CS Leaders and Supporters to complete Sections 3, 4, 5, 6 & 7
03/07/2023	0.5	Iván Ramos, Carla Rodríguez (CARTIF)	Inclusion of Sections completed

Date	Version	Contributors	Comments
06/07/2023	0.6	Iván Ramos (CARTIF)	Analysis of historical and future climate in each CS
28/07/2023	0.7	Carla Rodríguez (CARTIF)	Draft final version shared for review
22/09/2023	0.8	Iván Ramos, Carla Rodríguez (CARTIF)	Integration of comments from FBK, CMCC and ZSI reviewers
22/09/2023	1.0	Alessia Torre (FBK)	Final version and submission

Abbreviations and acronyms

Acronym	Description
AR6	Sixth Assessment Report
BAU	Business As Usual
CAP	Common Agricultural Policy
CC	Climate Change
CDD	Cooling Degree Days
CESEC	Central and South-Eastern European Gas Connectivity
CETS	European Charter for Sustainable Tourism
CFP	Common Fisheries Policy
CS	Case Study
DDBR	Danube Delta Biosphere Reserve
DMO	Destination Management Organization
DSO	Distribution System Operator
EC	European Commission
ECV	Essential Climate Variables
EDGAR	Emissions Database for Global Atmospheric Research
EE	Energy Efficiency
EEA	European Environmental Agency
ERTMS	European Rail Traffic Management System
ESCo	Energy Services Company
ETS	Emission Trading Scheme
EU	European Union
EUSALP	EU Strategy for the Alpine region
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GSTC	Global Sustainable Tourism Council
GVA	Gross Value Added
GRP	Gross Regional Product
HDD	Heating Degree Days
ICT	Information Communications Technology
IoT	Internet of Things
IPCC	Intergovernmental Panel on Climate Change
IPCEI	Important Project of Common European Interest
IPI	Industrial Production Index
KET	Key Enabling Technology
LCA	Life-Cycle Assessment
LNG	Liquefied Natural Gas
LULUCF	Land Use, Land-Use Change and Forestry
NAP	National Adaptation Plan
NCCAP	National Climate Change Adaptation Plan
NCCAS	National Climate Change Adaptation Strategy
NECP	National Energy and Climate Plan
NUTS	Nomenclature of Territorial Units for Statistics
NZEB	Nearly Zero Energy Building

OECD	Organisation for Economic Cooperation and Development
PCI	Project of Common Interest
PDO	Protected Designation of Origin
PEAP	Environmental Energy Plan of the Trentino Province (IT: Piano Energetico Ambientale Provinciale
PESTLE	Political-Economic-Social-Technological-Legal-Environmental
PNRR	National Recovery and Resilience Plan (IT: Piano Nazionale di Ripresa e Resilienza)
PPP	Public-Private Partnership
PV	Photovoltaic
RES	Renewable Energy Sources
SDG	Sustainable Development Goal
SEA	Strategic Environmental Assessment
SECAP	Sustainable Energy and Climate Action Plan
SET	Strategic Energy Technology (plan)
SME	Smart and Medium Enterprise
SPROSS	Trentino Provincial Sustainable Development Strategy (Agenda 2030) (IT: Strategia PROvinciale per lo Svilippo Sostanibile)
SSP	Shared Socioeconomic Pathways
TSO	Transmission System Operator
UN	United Nations
WP	Work Package
WSI	Water Stress Index
ESM	Earth System Models

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Executive summary

This document presents the work carried out for the case study characterization including the main results obtained at case study level. NEVERMORE aims to develop integrated models and tools for simulating and assessing the impacts and risks of climate change, to make mitigation and adaptation policies more effective.

The development of this deliverable has involved collaborative work between case study leaders, supporters and technical partners to carry out the most detailed analysis of the sectors, climate, policies and drivers that can play a relevant role in the evaluation of the effects of climate change in each case study in order to define feasible adaptation and mitigation pathways.

The document begins with the methodological approach necessary to carry out both the analysis of the geographical landscape and the climate conditions, including the analysis of the vulnerable sectors, the current and future climate, the definition of the baseline in adaptation and mitigation and the analysis of the legal framework that directly affects the identification and selection of policies to be implemented in each evaluated area. In addition, the methodology developed for the identification of the most relevant drivers at case study level is presented through the development of a PESTLE analysis following different steps and consultations with stakeholders.

After presenting the methodology, the document continues with the analysis and results for each case study covering the main points presented in the *Approach* section which were explained above. All the chapter that cover the case studies, follow the same structure to improve the understanding of the document and the comparison between case studies. Each case study section concludes with a summary of the main results and conclusions extracted from the characterization including the identification of drivers with the local stakeholders.

Although it is a very extensive document due to the fact that a very detailed evaluation of the five case studies that make up the local framework and scope of the NEVERMORE project is presented. The results obtained are the initial stage to continue working on the activities of the WP6 in order to be able to complete the risk and vulnerability analysis in each case study cases. This will help to provide solutions and tools so that the case studies can work on the development of plans and strategies that help them to improve the adaptation and mitigation of the effects of climate change.

In the legal framework, it must be considered that all the case studies have a deep legal framework that establishes the starting point for defining and guiding the strategy that helps to define the priority lines in climate adaptation and mitigation. This analysis of the legal and policy framework, which has been carried out jointly with WP5 activities, has been included as an *Annex* to this document to help in the understanding of the regulatory framework as a starting point of adaptation and mitigation in each case study.

The document ends with a series of conclusions and recommendations to continue working with the case studies and the following activities of the project, being able to offer solutions and tools adapted to the real needs and that really help in decision-making in climate adaptation and mitigation.

1. Introduction

WP6 "Analysis of climate change impacts and risk at case studies" aims at coordinating and carrying out the specific assessment, modelling and validation activities in each case study to identify the risks and impacts of climate change, and sustainable measures validating the NEVERMORE methodological approach. Case studies are characterised from a local point of view and also via adaptation and mitigation strategies in place analysis. Upscaling methodologies to calibrate the results of the damage functions at less detailed scales will be provided ensuring the consistency of local, national, EU and global scales for policy modelling.

Task 6.1 "Case study characterisation" aims at characterising the case studies through a threefold approach: **(1)** analysis of geographical landscape and historical conditions, identifying the most vulnerable areas of the region and the most relevant weather/climate change factors; **(2)** a PESTLE analysis to understand which are political-social-regulatory-technological-economic-environmental drivers of the local ecosystem and economy with inputs from T2.2; **(3)** merging such two points to make a socio-economic and environmental characterization of each case study, including a preliminary evaluation of key vulnerable sectors and infrastructures, identifying the variables and boundaries that could have extreme impacts on each case study area (e.g., key economic sectors and infrastructure that could lead to socio-economic tipping points to be identified among agricultural, energy, tourism, transport and local industry). The local analysis will consider the sectors most affected by climate change (supported by inputs from the Council of Stakeholders at local level), prioritizing them and, for each of these sectors, identifying the key elements and infrastructures that will be vulnerable to disasters or extreme events (e.g., roads, plants, energy grids, water networks…).

To start with this local characterization, NEVERMORE project brings 5 **case studies**, including different climate change hot-spots such as islands, Boreal, Mediterranean and Alpine regions (see Figure 1). Each case study is facing different effects of climate change being relevant to understand how effective action plans could be developed to mitigate and adapt to the expected climate impacts and provide for mechanisms to reduce the climate risk.

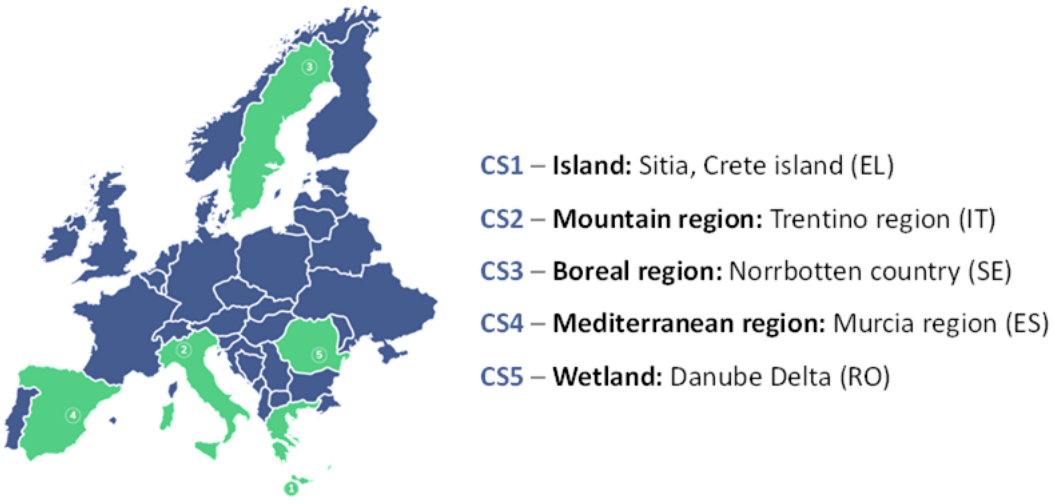


Figure 1. EEA classification of regions according to climate change impacts and location of the Case Studies.

In the following table (Table 1), a first description to put each case study in context is provided, including the main preliminary vulnerable sector identified at proposal stage, the socio-economic context and the challenges to be covered with policy implementation and action plan development.

Table 1. Summary of NEVERMORE Case Studies.

Case Study	Lead (L) & Supporter (S)	Main vulnerable sectors	Socio-economic context	Main challenges
CS1 – **Island** Sitia, Crete (GR)	**L: SITIA** S: NCSRD	• Agriculture, forestry and fishing • Water and waste • Biodiversity and natural heritage • Tourism, leisure and cultural heritage	• Agriculture (PDO products) • Tourism	**Hot-spot**: Sea level raise, flooding and droughts. Preserve biodiversity, food chain and archaeology.
CS2 – **Mountain region** Trentino (IT)	**L: PAT** S: FBK	• Energy • Tourism, leisure and cultural heritage • Water and waste • Biodiversity and natural heritage	• Winter tourism • Energy production	**Hot-spot**: rising temperature, unpredictable precipitation patterns, modified seasonal climate dynamics.
CS3 – **Boreal region** Norrbotten County (SE)	**L: EKNorr** S: IVL	• Agriculture, forestry and fishing • Energy • Industry and commerce • Transport • Tourism, leisure and cultural heritage • Biodiversity and natural heritage	• Energy production • Reindeer • Tourism	**Hot-spot**: Need of upgrading the energy system and allocation of resources for climate adaptation.
CS4 – **Mediterranean region** Murcia region (ES)	**L: INFO** S: CARTIF	• Agriculture, forestry and fishing • Water and waste • Industry and commerce • Tourism, leisure and cultural heritage	• Agriculture • Tourism • Industry	**Hot-spot**: Desertification due to soil erosion in agricultural systems. Sustainable water management.
CS5 – **Wetland** Danube Delta (RO)	**L: TULCEA** S: SIMAVI	• Agriculture, forestry and fishing • Energy • Water and waste • Tourism, leisure and cultural heritage • Industry and commerce	• Agriculture • Low education level • Economical dependency	**Hot-spot**: Environmental and ethnic wealth protection. Sustainable tourism and eco-agriculture promotion. Land-use management.

1.1. Structure of the document

Thus, the **D6.1 "Report on NEVERMORE case studies characterisation"** gathers the case studies characterisation in terms of local ecosystem context, geographical landscape and historical climatic conditions, providing a socio-economic and environmental characterisation of them.

It is structured in the following sections:

- **Section 1:** (current section) introduces the document, as well as the WP and Task, and the case studies of the Project.
- **Section 2:** recaps how the characterisation of the case studies is **approached**, through a threefold methodology:
  - **Section 2.1:** describes the analysis of the **geographical landscape and historical climate conditions**, which in turn is divided into three parts:
    - **Section 2.1.1** for the **climate analysis and characterisation of vulnerable sectors**), which includes the analysis of climate and weather, and the identification and characterisation of the vulnerable sectors and its exposure assets within each case study.
    - **Section 2.1.2** for the **climate change factors analysis**, which includes an adaptation and mitigation baseline for each case study.
    - **Section 2.1.3** for the **past experience and legal framework analysis**, with the identification of relevant documents, and a deeper analysis for those more relevant and interesting for each case study.
  - **Section 2.2:** includes the **PESTLE analysis methodology** to analyse the local ecosystem drivers in the case studies.
- **Sections 3 to 7:** presents the **characterisation of each case study**, following the methodology in Section **2**, with the same sub-sections structure. Specifically:
  - **Section 3**: includes the characterisation of the **Case Study 1, Island, Sitia - Crete** in Greece.
  - **Section 4**: provides the characterisation of the **Case Study 2, Mountain region, Trentino** in Italy.
  - **Section 5**: recaps the characterisation of the **Case Study 3, Boreal region, Norrbotten County** in Sweden.
  - **Section 6**: depicts the characterisation of the **Case Study 4, Mediterranean region, Murcia region** in Spain.
  - **Section 7**: includes the characterisation of the **Case Study 5, Wetland, Danube Delta** in Romania.
- **Section 8**: includes an overview of the overall socio-economic and environmental issues, considering inputs from Task 2.2 "Analytical framework for socio-economic factors and the uptake of climate change models", and the next steps.

At the end of the report, both **Section 9** on **Conclusions** and **Section 10** on **References** are included.

Finally, **Section 11** includes **Annexes**, with two devoted **annexes for each case study** (**sections** from **11.1** to **11.10**) in which the complete analysis performed for the **past experience documents** identification and deeply analysis are included, as well as the complete results of the three **PESTLE analysis** activities for the **local ecosystem drivers' analysis**.

2. Approach

The characterisation of the case studies is done following a threefold approach, depicted in next sub-sections: analysis of geographical landscape and historical conditions (**section 2.1**), which includes the identification of vulnerable areas and sectors (**subsection 2.1.1**), the climate change factors analysis (**subsection 2.1.2**), and the past experience and legal framework analysis (**subsection 2.1.3**); then a PESTLE analysis is performed to understand the different drivers of the local ecosystem and economy in the five case studies (**section 2.2**); and both inputs are merged to make a socio-economic and environmental characterization of each case study.

It is necessary to highlight that the analyses under the geographical landscape and historical conditions include the collection of needed data for such characterisations (e.g., population, roads, buildings, etc.), which will serve as input data for the other modelling activities of WP6 afterwards.

Thus, the activities of the current task are divided into the **case study analysis** and the **diagnosis**. The analysis of the case studies includes the data collection in all relevant and vulnerable sectors of each, while the diagnosis part includes the PESTLE analysis and the complete socio-economic and environmental characterisation. In the Figure 2 below the planning with timeline for such activities is depicted.

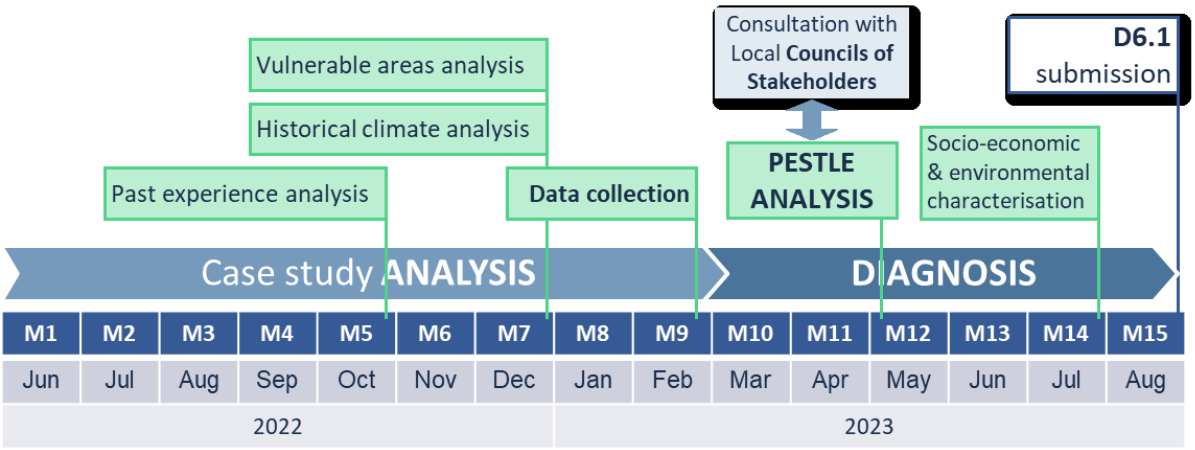


Figure 2. Task 6.1 planning of activities.

The approach for the task and collection of data in the first part of analysis of geographical landscape and historical climate conditions can be seen in Figure 3. This figure presents the methodological approach adopted during the task implementation in order to collect relevant data at case study level with the help of the case study leaders and integrate the Local Council requirements and needs to define the most relevant challenges and objectives at case study level. All the collected information will be useful to guide the implementation of the modelling activities at case study level and also to define feasible action plans integrating needs from the involved stakeholders.

It is also necessary to reflect that data collection is a hard task due to the need of data that is not always publicly available, or data covering specific scales that are out of the case study boundaries. In this second case, downscaling is useful to provide high-resolution datasets that fit for purpose in the case study characterization. These downscaling procedures were applied for example with climate data and emissions to provide case studies with information to understand the main climate change insights and the emissions pattern respectively. Statistical downscaling procedures (e.g., quantile mapping) were applied to improve the data spatial resolution.

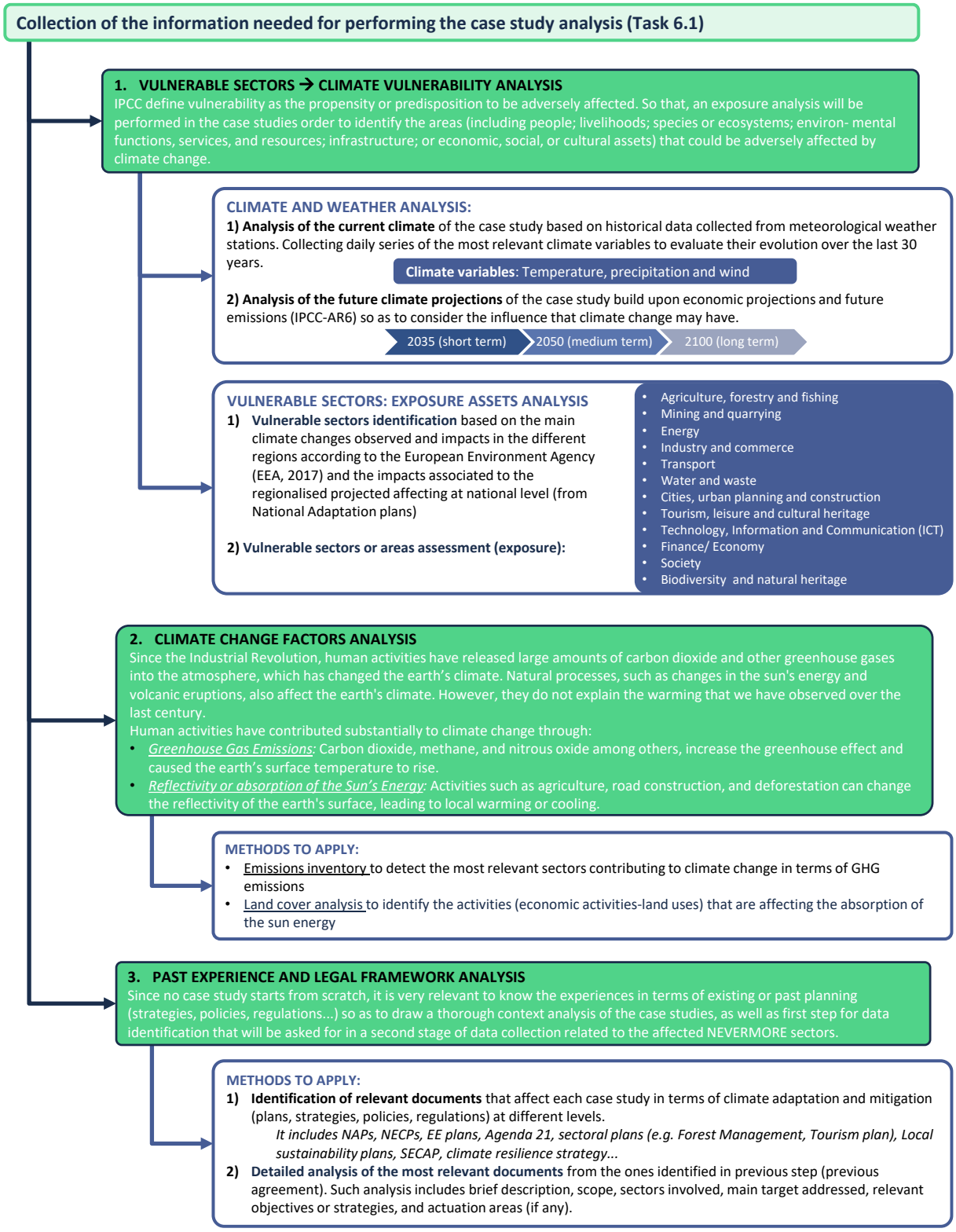


Figure 3. Approach for the collection of data for case studies' characterisation (Task 6.1).

2.1. Analysis of geographical landscape and historical climate conditions

2.1.1. Climate analysis and characterisation of vulnerable sectors

IPCC defines vulnerability as the propensity or predisposition of a system to be adversely affected by climate variation. It is a function of the character, magnitude and rate of climate variation to which a system is exposed, its sensitivity and its adaptive capacity**.** So that, as starting point, an exposure analysis will be performed in the case studies in order to identify the areas (including people; livelihoods; species or ecosystems; environmental functions, services and resources; infrastructure; or economic, social, or cultural assets) that could be adversely affected by climate change.

For that, both climate and weather analysis including also an exposure analysis by means of a sectoral characterization were performed as it is detailed in following sections.

2.1.1.1. Climate and weather analysis

Climate and weather analysis are performed through two analyses based on Essential Climate Variables (ECV) (temperature, precipitation and wind). The one for the historical climate period (representing the current climate or the current trends), while the second one for the future climate projections (Figure 4), covering two future climate scenarios (SSP245 and SSP585) and three different periods (short, medium and long-term).

Figure 4. Climate vulnerability analysis approach.

- **Analysis of the current climate** of each case study based on historical data (reanalysis) collected from Copernicus Climate Change Initiative (C3S) (CERRA climate reanalysis). Collecting daily series of the most relevant climate variables to evaluate their evolution over the last 30 years of a reference period (1985-2015). The climate variables that are used to characterize the climate of each case study are presented in Table 2. The spatial resolution of CERRA dataset is 5.5 km.

Table 2. Climate variables to collect for the analysis of current climate

CLIMATE VARIABLES	INDICATORS
Temperature	• Mean annual daily mean temperature (ºC) • Mean annual daily maximum temperature (ºC) • Mean annual daily minimum temperature (ºC)
Precipitation	• Mean annual daily cumulated precipitation (mm/day) • Maximum annual daily cumulated precipitation (mm/day)
Wind	• Mean annual daily mean surface wind speed (m/s)

- **Analysis of the future climate projections** of the case study build upon economic projections and future emissions (IPCC-AR6) so as to consider the influence that climate change will have in each case study. The scenarios to be used for the future projections are SSP245 and SSP585, representing two different economic and emissions trajectories. SSP245 could be defined as a Business As Usual (BAU) scenario while SSP585 could be considers as a pessimistic scenario in which emissions due to fossil fuel are increasing without control. A statistical downscaling of the results from different climate models was developed by CMCC in order to generate future climate datasets at 5.5 km of spatial resolution. Models were selected from those available in Copernicus C3S. In Table 3, the set of models used to provide data on the future climate are detailed.

Table 3. Selected climate models for future climate characterization.

MODEL	DESCRIPTION
ACCESS-CM2	Australian Community Climate and Earth System Simulator Climate Model Version 2
CESM2	Community Earth System Model Version 2
CNRM-ESM2-1	Earth system model of CNRM, 2nd generation, developed by the CNRM/CERFACS
EC-Earth-Veg-LR	EC-Earth is a modular ESM developed by the EU consortium with the same name
HadGEM3-GC31-LL	ESM developed by the Met Office Hadley Centre (MOHC)
IPSL-CM6A-LR	Latest version of the IPSL climate model developed by Institute Pierre Simon Laplace
MIROC6	Sixth version of the Model for Interdisciplinary Research on Climate (MIROC) developed by a Japanese modelling community
NorESM2-MM	The Norwegian Earth System Model 2nd version by the Norwegian Climate Centre (NCC)

2.1.1.2. Vulnerable sectors: identification of exposure assets

The exposure analysis intends to analyse the different vulnerable sectors or areas in the case studies. Economic activities, such as agriculture, forestry, fisheries and mining are exposed to changes in the climate that could affect them in a negative way. All identified sectors will be influenced by climate change the one way or the other – manufacturing will also be influenced by water scarcity, when water is needed in the manufacturing process, by electricity shortages caused by climate change (e.g., through electricity generated by water power and little precipitation, leading to lower levels of energy produced etc.). In addition, markets connect sectors so that the impacts of climate change spill over from one activity to all others. The impact of climate change on the economic development and growth also affects all sectors and activities at case study level.

Thus, the exposure analysis was performed following two different studies. The first one, following the definition of the NEVERMORE sectors, is focussed on the identification of the most vulnerable sectors that are affected by climate change in the case studies. The second one, is for the assessment and characterisation of those vulnerable sectors identified in each case study.

- **Vulnerable sectors definition:** the **NEVERMORE sectors** were identified based on the main climate changes observed and impacts in the different regions according to the European Environment Agency (EEA, 2017) (Figure 5) as well as the regionalised impacts from the national level (evaluating National Adaptation plans, which in Europe are mainly focus on floods and droughts, oceans, agriculture and fisheries, forests, human health and energy).

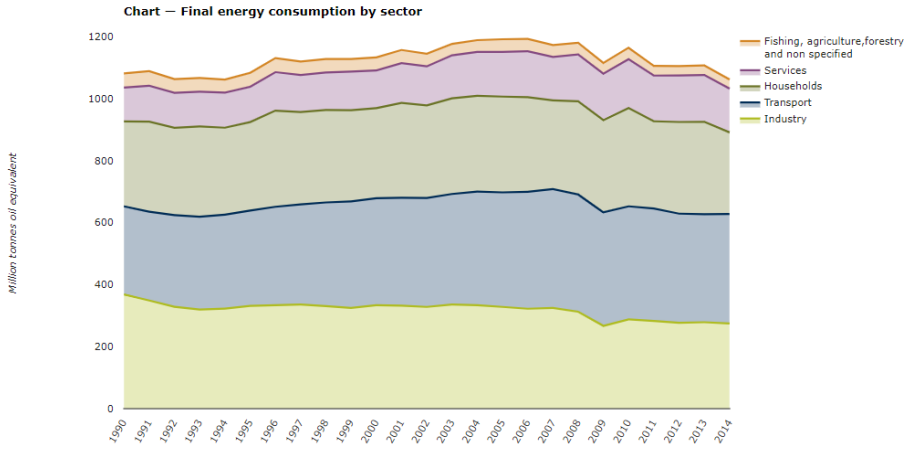


Figure 5. Final energy consumption by sector in Europe over the years (1990 to 2014). ***Source: EEA, 2017***[1]

[1] EEA, 2017: https://www.eea.europa.eu/data-and-maps/indicators/final-energy-consumption-by-sector-9/assessment-1/

On this basis, the NEVERMORE sectors and the related sectoral data to be collected were identified for their characterization, relating them to climate change impacts. Then, relevant indicators for the characterization were defined. This sector definition was a collaborative effort between CARTIF, UVa and RINA-C to align methods under the same sectors. In the following table (Table 4) the NEVERMORE sectors are depicted, together with the main sectoral data and CC impacts related.

Table 4. NEVERMORE sectors for data collection for vulnerable sectors or areas assessment.

SECTORS (Clusters)	Sectoral data	CC impact related
Agriculture, forestry and fishing	• Agricultural production • Agricultural labour force • Livestock production • Livestock labour force • Fishing resources • Fishing labour force • Forestry surface • Forestry resources • Forestry labour force	• Change in crop productivity • Change in livestock productivity • Change in livestock population • Change in fishing productivity • Change in forest suitability areas • Change in photosynthetic capacity • Change in potential growth of plants
Mining and quarrying	• Number of mines • Minerals (number/ variety) • Production of ores • Mining industry labour force	• Change in ores productivity • Change in mines productivity
Energy (incl. energy production and distribution infrastructures)	• Final energy demand • Energy demand • Wind energy production • Hydroelectric energy production • Solar energy production	• Increase in energy demand (heating and cooling) • Change in wind power potential • Change in potential of hydroelectric power • Change in solar radiation/ potential
Industry and commerce (incl. refinery, chemicals, metals, other manufacturers)	• Industrial production • Industrial labour force	• Change in production (due to change in resources: labour, capital, land, water…) • Change in productivity
Transport (incl. transport infrastructure)	• Extension of roads • Road maintenance costs • Extension of rail infrast. • Rail maintenance costs • Public transport use • Ship traffic • Ship travels	• Damage in transport infrastructure • Damage in transport infrastructure affecting public transport service • Change in flow/water levels
Water and waste (incl. water treatment and distribution infrastructures)	• Water availability • Water efficiency • Water supply • Wastewater • Irrigation • Water pollution • Water management • Waste management	• Change in precipitation distribution/ hydrological variability • Droughts • Change in precipitation patterns and quantities • Water scarcity and completion for water • Worsening water quality

SECTORS (Clusters)	Sectoral data	CC impact related
Tourism, leisure and cultural heritage	• Tourism quantity • Tourism economy	• Change in tourism flow (geographically) • Change in tourism flow (seasonal)
Finance/ Economy	• Economy and investment • Production of different sectors • Labour force in different sectors	• Investment in adaptation due to increase in temperature
Society (incl. human health, wellbeing, migration and education)	• Demand for health care services • Expenditure in health • Mortality and morbidity caused by heat waves • Premature mortality caused by heat waves • Premature mortality caused by temperature changes • Population wellbeing • Population change, migration	• Increase of morbidity • Effects of heat waves in human health • Effects of climate change in human health • Change in population • Effects of temperature increase in wellbeing
Biodiversity and natural heritage	• Biodiversity of animal species • Biodiversity of flora species • Biodiversity (animal/flora) *sps* • Natural vegetative surface	• Fauna loss • Flora loss • Flora and fauna loss • Natural vegetative surface loss

- **Vulnerable sectors or areas assessment (exposure).** This was done in each case study, starting from the prioritization of their key vulnerable sectors. These sectors were pre-identified at proposal stage, and reviewed during the project activities with the case study leaders and supporters, as well as during the first Case Study Consultation to double check and set the final list.

The first case study consultation was divided into two parts, the first part was set with case study leaders in a common online meeting for all case studies, with breakout rooms to bring the specific discussions of the topics of each case study. This was held the 5th December 2022. Then, a consultation with each Local Council of Stakeholders was organised at case study level.

For the first part, a consultation with the Case Study 3 (Norrbotten County) Leader was held, to act as pilot for the others afterwards. Then, the consultation with the rest of Case Study Leaders was held, focusing on the specific challenges and other topics of each on during the breakout rooms. In relation to the task 6.1, it was discussed about the case study **challenges**, through an activity that then related them with **sectors affected**, and finally to link with **priorities and motivations** (Figure 6). This activity was done online through Jamboard interactive tool, and its results are included in the corresponding section of each case study.

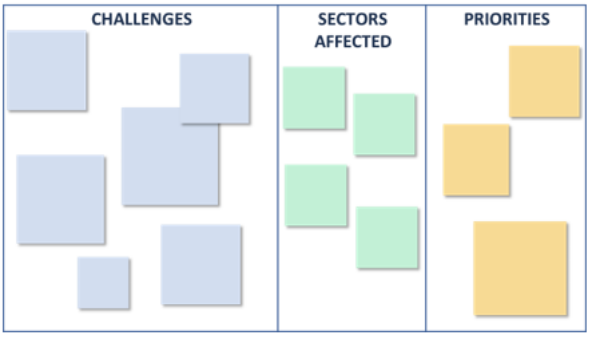


Figure 6. Challenges, sectors affected and priorities analysis of the case studies – online activity during the first consultation with case study leaders

The first consultation with the **Local Council** of each case study was held around M9 (February 2023). Depending on each case study circumstances and possibilities, as well as the level of engagement of the stakeholders, the meetings were held either in person or online. The structure of the consultations was similar in all the five case studies and were structured as follows: a general presentation to introduce the NEVERMORE project, the presentation of the case study, its objectives and activities. Then, similar activities to those held during the first "internal" consultation, were conducted with the local stakeholders. The relation with T6.1 is again the activity for the identification of local challenges and priorities related to one's sector with regard to climate change.

In Table 5, the final results on the key vulnerable sectors in each case study is shown in a visual way, in which the number "1" is for key vulnerable sectors in the case studies, while number "2" indicate second priority vulnerable sectors. Both "finance/economy" and "society" sectors are marked in a different colour since they will be assessed for all case studies by the socio-economic context.

Table 5. NEVERMORE key vulnerable sectors for the case studies (prioritized).

SECTORS (Clusters)	CS1 (Sitia)	CS2 (Trentino)	CS3 (Norrbotten)	CS4 (Murcia)	CS5 (Danube Delta)
Agriculture, forestry and fishing	1		1	1	1
Mining and quarrying			2		
Energy		1	2		1
Industry and commerce				2	2
Transport					
Water and waste	1	2		1	1
Tourism, leisure and cultural heritage	2	1	1	2	1
Finance/ Economy	*All case studies for the socio-economic context*				
Society	*All case studies for the socio-economic context*				
Biodiversity and natural heritage	1	2	1		

The detailed characterisation of the vulnerable sectors in each case study is detailed in the following **sections (3 to 7)**.

Before starting with the characterization, Case Studies were asked to confirm or modify the boundaries defined at proposal stage, considering that for data collection purposes, it would be better if the CS boundaries are the same as administrative boundaries, as data tends to be found in databases as the

latter (i.e. NUTS 2 or NUTS 3). The boundaries of each CS are also reported in their corresponding sections, as part of the introduction to the case study.

2.1.2. Climate change factors analysis: adaptation and mitigation baseline

Since the Industrial Revolution, human activities have released large amounts of carbon dioxide and other greenhouse gases into the atmosphere, which has changed the Earth's climate. Natural processes, such as changes in the sun's energy and volcanic eruptions, also affect the Earth's climate. However, they do not explain the warming that we have observed over the last century. Although climate is a global concern, it is necessary to define a baseline at local level in order to understand how join efforts could help to reduce climate impact or adapt to expected changes integrating the anthropogenic effects in the mitigation patterns.

Human activities have contributed substantially to climate change through:

- *Greenhouse Gas Emissions:* Carbon dioxide, methane, and nitrous oxide among others, increase the greenhouse effect and caused the earth's surface temperature to rise.
- *Reflectivity or absorption of the Sun's Energy:* Activities such as agriculture, road construction, and deforestation can change the reflectivity of the earth's surface, leading to local warming or cooling.

Therefore, for the climate change factors analysis in each case study, both the emissions inventory and the biomass analysis will be considered as part of their characterisation:

- Emissions inventory to detect the most relevant sectors contributing to climate change in terms of GHG emissions with focus on carbon dioxide. It could help to define the starting point understanding the emissions pattern in the past and the role of measures contributing to reduce the emissions level in each sector.
- Biomass and soil analysis to identify the carbon stock in soil and biomass to give us an idea of the case study potential as carbon dioxide sink. Applying geolocated data on biomass from the European Space Agency (ESA) (Biomass Climate Change Initiative[2]) and soil data from FAO (Global Soil Organic Carbon Map[3]), the carbon stock of each case study was calculated. To translate biomass stock into carbon stock in biomass a coefficient of 0.5 was applied according to IPCC Land Use, Land-Use Change and Forestry guidelines[4].

2.1.3. Past experience and legal framework analysis

Since no case study starts from scratch, it is very relevant in a **first stage** to know the experiences in terms of existing or past regulations and planning (e.g., strategies, policies, regulations, etc.) to draw an initial analysis of the case studies, as well to identify the data related to the affected NEVERMORE sectors that will be collected in a **second stage**.

To do so, two different templates were prepared to perform these assessments under a two-step methodology, the first one to identify the key documents of the case studies that could be relevant for the NEVERMORE purpose (so, related to climate change adaptation and mitigation), and the second one to develop a deep analysis of the more relevant ones, or those that include greater information. This is detailed in the following sections.

[2] https://data.ceda.ac.uk/neodc/esacci/biomass/data/agb/maps/v4.0
[3] https://data.apps.fao.org/glosis/?share=f-6756da2a-5c1d-4ac9-9b94-297d1f105e83&lang=en
[4] https://www.ipcc.ch/report/land-use-land-use-change-and-forestry/

2.1.3.1. Identification of relevant documents

The first step carried out by each case study was they had to identify relevant documents that affected them in terms of climate adaptation and mitigation (e.g., plans, strategies, policies, regulations) at different levels. The identified policy documents included:

- National Adaptation Plans (NAPs) or National Energy and Climate Plans (NECPs)
- Plans or programmes to promote Energy Efficiency
- Agenda 21, Local sustainability plans
- Sectoral plans (such as Forest Management plans, Tourism plans…)
- Signature and compliance of the Covenant of Mayors (and Sustainable Energy and Climate Action Plan: SECAP)
- Climate resilience strategy

A template was provided in Spreadsheet format (Figure 7) with the following fields to fill in with key and basic information from each identified document (Table 6 and Table 7), to be able to select the most relevant ones for further analysis.

Table 6. Fields and their explanation included in the Spreadsheet template to identify the relevant documents related to climate change adaptation and mitigation in the case studies.

Name of the document	Type of document	Web link (if any)	Scope	Year of adoption	Main sectors involved	Main target/ Aim
It should be translated to English, although it can be added in the original language if wished.	*To select from drop-down menu:* • Plan • Strategy • Policy • Regulation • Law • Project • Guideline • Roadmap • Other	*To provide the link to a web site if it is available.*	*To select from drop-down menu:* • National • Regional • Sectoral • Metropolitan • Local • Other	*To add the year in which the plan was set/ adopted*	*To select from drop-down menu (list of NEVERMORE sectors):* • Agriculture, forestry and fishing • Mining and quarrying • Energy • Industry and commerce • Transport • Water and waste • Cities and urban planning • Tourism, leisure and cultural heritage • ICT • Finance/ Economy • Society • Biodiversity and natural heritage	*To add the main aim or target of the document. Few lines to understand its main purpose/ content.*
					Possibility to select more than one sector.	

Table 7. Example of a document from CS4 (Murcia) in the template of relevant documents identification.

Name of the document	Type	Web link	Scope	Year of adoption	Main sectors involved	Main target/ Aim
National Plan for Adaptation to Climate Change (NAP) 2021-2030 | (ES: Plan Nacional de Adaptación al Cambio Climático 2021-2030 - PNACC)	Plan	https://www.miteco.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/pnacc-2021-2030_tcm30-512163.pdf	National	2021	Water and waste Biodiversity and natural heritage Agriculture, forestry and fishing Tourism, leisure and cultural heritage Energy Transport Industry and commerce	It is the basic planning instrument to promote coordinated and coherent action against the effects of climate change in Spain, in order to avoid or reduce present and future damage caused by climate change and build a more resilient economy and society.

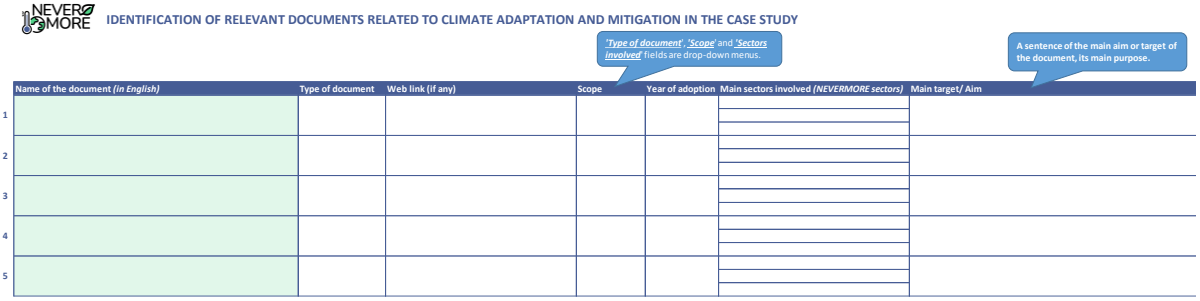


Figure 7. Screenshot of the Spreadsheet template provided to identify the relevant documents related to climate adaptation and mitigation in each case study.

The following table (Table 8) summarises the number and scope of the identified documents in each case study, as well as the ones that were selected for further analysis.

Table 8. Relevant documents related with climate change adaptation and mitigation identified by each case study and final selected ones for the deep analysis

Case Study	Documents identified (scope)	Documents selected for a deeper analysis
CS1 Sitia – Island (Greece)	**4** documents identified: • 2 Strategies (1 national, 1 regional) • 1 Plan (1 sectoral) • 1 Guideline (1 local)	**All 4** documents analysed: • 1 Strategy (both merged as one included the other: 1 national + 1 regional) • 1 Plan (1 sectoral) • 1 Guideline (1 local)
CS2 Trentino – Mountain (Italy)	**27** documents identified: • 3 Strategies (2 national, 1 regional) • 9 Plans (2 national, 6 regional, 1 local) • 3 Law (3 regional) • 2 Regulation (2 regional) • 3 Project (1 regional, 2 local) • 1 Policy (1 national) • 1 Guideline (1 national)	**10** documents analysed: • 7 Plans (2 national, 5 regional) • 2 Strategies (1 national, 1 regional) • 1 Project (1 local)

Case Study	Documents identified (scope)	Documents selected for a deeper analysis
	• 5 Other (2 national, 3 regional)	
CS3 Norrbotten – Boreal (Sweden)	**39** documents identified: • 13 Strategies (5 national, 4 regional, 4 sectoral) • 16 Plans (4 national, 9 regional, 3 sectoral) • 6 Guidelines (1 national, 5 sectoral) • 1 Policy (1 sectoral) • 2 Roadmaps (1 sectoral, 1 regional) • 1 Other (1 sectoral)	**13** documents analysed: • 3 Strategies (1 national, 1 sectoral, 1 regional) • 9 Plans (2 national, 4 regional, 3 sectoral) • 1 Guideline (1 sectoral)
CS4 Murcia – Mediterranean (Spain)	**21** documents identified: • 1 Roadmap (1 regional) • 3 Strategies (1 regional, 2 sectoral) • 6 Plans (2 national, 1 regional, 3 sectoral) • 2 Guideline (2 other) • 1 Law (1 other) • 8 Other (1 national, 5 regional, 2 other)	**8** documents analysed: • 1 Roadmap (1 regional) • 1 Strategy (1 regional) • 6 Plans (2 national, 1 regional, 3 sectoral)
CS5 Danube – Wetland (Romania)	**11** documents identified: • 5 Strategies (4 national, 1 local) • 1 Plan (1 national) • 1 Project (1 national) • 2 Policies (2 national) • 1 Law (1 national) • 1 Other (1 national)	**All 11** documents analysed: • 5 Strategy (4 national, 1 local) • 1 Plan (1 national) • 1 Project (1 national) • 2 Policies (2 national) • 1 Law (1 national) • 1 Other (1 national)

2.1.3.2. Detailed analysis of the most relevant documents

For the second step of the analysis of relevant documents for each case study, related to climate change adaptation and mitigation, a second template was prepared to add more detailed information on the selected ones (Table 8). This selection was made considering their influence in the priority sectors. Such analysis included a brief description, scope, sectors involved, main target addressed, relevant objectives or strategies, policies and measures, and actuation areas (if any). The template was provided in the same Spreadsheet as the identification of documents, just adding several tabs, one per selected document with the template to be completed. The template had some fields already filled in with the information provided at first stage for the identification. In Table 9, the different fields of the template including instructions provided are depicted.

Table 9. Fields and their explanation in the template to deeply analyse the most relevant in each case study.

Case Study	Case Study no. & name		
#1	**Name of the document** (in English, and if wished original name can be added too)		
Type of document	From "Identification" tab, list of elements to select: ***Plan, Strategy, Policy, Regulation, Law, Project, Guideline, Roadmap, Other***	**Language(s)**	To add all languages in which it is available
Scope	From "Identification" tab, list of elements to select: ***National, Regional, Sectoral, Metropolitan, Local, Other***	**Year of adoption**	From "Identification" tab
Web link	From "Identification" tab	**Target year**	Year to which the objectives of the plan are set

Brief description	Main purpose of the plan/document, with a focus on case study particularities/ key sector (vulnerable sector)
Sectors involved	From "Identification" tab List of elements to select
Main target addressed	From "Identification" tab, main aim or target of the document, its main purpose, also in relation with the case study key vulnerable sectors
Other relevant objectives or strategies addressed	
O1	To highlight the objectives or strategies included in the document that are relevant to the climate change adaptation/mitigation in the case study
O2	
O3	
O4	
…	
Relevant policies and measures included	
P&M1	To include relevant policies and measures proposed in the plan/document to accomplish with the identified objectives. These policies and measures can be related with the previous objectives
P&M2	
P&M3	
P&M4	
…	
Actuation areas	To add if specific (geographical) areas are affected by actions of the plan/document, or clarify if it is generally applicable to the whole case study territory/boundaries
Additional relevant information	To add further relevant information not covered in previous fields

Due to the complexity of performing the analysis for some big documents, the template allowed the adaptation to better analyse the objectives, measures and policies included in the documents. This was mainly done to better associate objectives to the measures, since some of the policy documents for each objective has several measures included.

2.2. PESTLE analysis for the local ecosystem drivers' analysis

In order to better understand the drivers (as enabling factors) for the local ecosystem and economy, the PESTLE analysis (Figure 8) is developed, to identify the political-economic-social-technical-legal-environmental drivers in each case study.

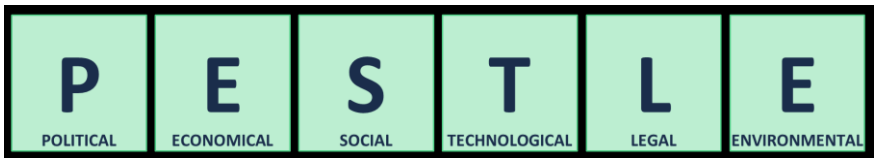


Figure 8. PESTLE meaning.

A **PESTLE analysis** is an easy-to-use tool that allows to understand the impact of main factors and drivers on a system and facilitates strategic planning. Each concept is an external factor that could represent a threat or an opportunity for each case study, now and in the future.

According to the Cambridge definition, a **driver** is something that makes another things progress, develop or grow stronger. So, in the context of NEVERMORE, we understand drivers as enabling factors or facilitators that will make our life easier mainly in what the design and deployment of policies to overcome the climate change impacts and adapt to it respects. Thus, drivers should also be related to the challenges and goals of the case studies, as well as to its vulnerable sectors. For a better understanding of the conceptual idea behind the PESTLE, some drivers for each aspect are presented:

- Political factors: laws and policies that may influence the case study. It could also include fiscal and monetary policies, employment policies, trade agreements, etc.
- Economic: macroeconomic variables such as GDP, employment rate, inflation, interest rates or the current economic situation.
- Social: consumption habits, cultural patterns, demographic evolution, lifestyle, values, beliefs
- Technological: changes in technology, its cost of access, investments in R&D&I, technological obsolescence, process automation
- Legal: legal regulations to comply with, as for example labor laws.
- Ecological: Aspects related to environmental conservation including legislation and trends.

The PESTLE analysis was conducted through several activities in all case studies. First, a face-to-face activity during the Sitia Consortium meeting in June 2023 was held. This consisted in a first brainstorming of the main drivers in the different aspects of the PESTLE for each case study. The activity was organised in round tables, one per case study with the case study leaders and supporters. The inputs were gathered in Jamboard online tool (Figure 9), in order to enable the online participants also to take part. In that exercise, the PESTLE was done in a broader way, and not only the drivers (as positive things already in place) were considered, but also negative aspects of the case studies were collected as challenges to be considered in the last exercise of the PESTLE activity (Figure 11).

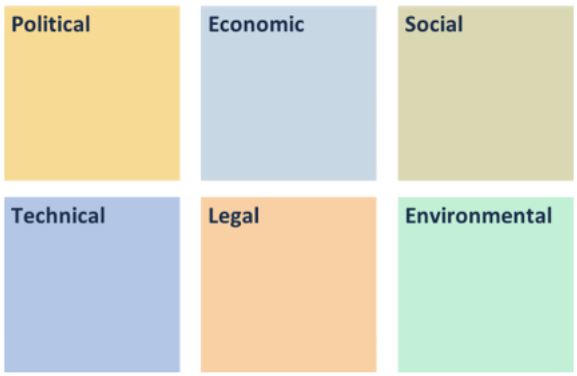
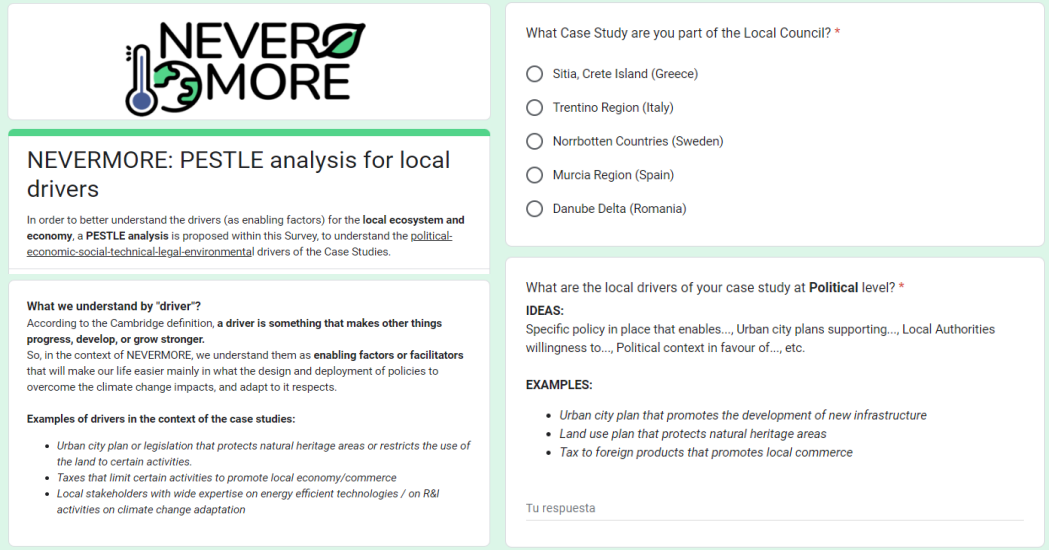


Figure 9. PESTLE analysis of local ecosystem drivers – activity proposed through Jamboard in Sitia meeting.

Additionally, the initial PESTLE analysis of local ecosystem drivers from this preliminary activity run in Sitia was validated with a contrast exercise with the Local Council of Stakeholders of each case study, to obtain more inputs and views on the drivers for each of them. This has been done through a Google Forms survey (Figure 10), translated to each local language and sent to the Council members to be completed with at least one driver on each PESTLE aspect. For the question on each aspect, both ideas and examples were included to guide them.



NEVERMORE: PESTLE analysis for local drivers

In order to better understand the drivers (as enabling factors) for the **local ecosystem and economy**, a **PESTLE analysis** is proposed within this Survey, to understand the political-economic-social-technical-legal-environmental drivers of the Case Studies.

What we understand by "driver"?
According to the Cambridge definition, **a driver is something that makes other things progress, develop, or grow stronger.**
So, in the context of NEVERMORE, we understand them as **enabling factors or facilitators** that will make our life easier mainly in what the design and deployment of policies to overcome the climate change impacts, and adapt to it respects.

Examples of drivers in the context of the case studies:

- *Urban city plan or legislation that protects natural heritage areas or restricts the use of the land to certain activities.*
- *Taxes that limit certain activities to promote local economy/commerce*
- *Local stakeholders with wide expertise on energy efficient technologies / on R&I activities on climate change adaptation*

What Case Study are you part of the Local Council? *

- Sitia, Crete Island (Greece)
- Trentino Region (Italy)
- Norrbotten Countries (Sweden)
- Murcia Region (Spain)
- Danube Delta (Romania)

What are the local drivers of your case study at **Political** level? *

IDEAS:
Specific policy in place that enables..., Urban city plans supporting..., Local Authorities willingness to..., Political context in favour of..., etc.

EXAMPLES:

- *Urban city plan that promotes the development of new infrastructure*
- *Land use plan that protects natural heritage areas*
- *Tax to foreign products that promotes local commerce*

Tu respuesta

Figure 10. Screenshot of the activity in Google Form sent to the Local Council of the case studies for the contrast of the PESTLE analysis of local ecosystem drivers.

Then, the results of both activities were processed and further developed in a third activity through a Spreadsheet in which the vulnerable sectors identified as key for the case study are highlighted, with a first reflection part about the challenges related to those vulnerable sectors and the goals to overcome them (Figure 11).

NEVERMORE - PESTLE analysis of local drivers in the case studies

SITIA

Vulnerable sectors:	Agriculture, forestry and fishing		
	Water and waste		
	Biodiversity and natural heritage		
	Tourism, leisure and cultural heritage		
Challenges (mainly related with the vulnerable sectors):	Maintain agricultural productivity (presently use of pesticides and chemical fertilizers)	**Goals (to overcome the challenges):**	Eco-friendly (bio) solutions instead of chemical pesticides
	Environmental footprint of wind farms		Better wind turbine design and placement: taller turbines, shorter blades, and placement away from bird habitats.
	Protection of NATURA 2000 sites and natural marine areas		Protection of marine areas through targeted activities (awareness campains, volunteering groups)
	Prevention of invasive alien species (plants&animals)		Legal framework and monitoring campains for prevention of invasive alien species (plants&animals)
	Monitoring technologies (agriculture, extreme events)		Development of Monitoring technologies (weather stations, water quality and consumption, flooding)
	Municipality of Sitia data availability and distribution		Existing data consistency and availability
	Droughts / Dry - thermal conditions		Construction of water dams
	Floods from climate extremes		Development of irrigation systems
	Water scarcity		Flood-protection constructions
	Wild fires		Early warning systems, areas' risk characterization
	Coastal erosion		Construction of breakwaters and artificial reefs
			Study for the urban planning/ appropriate legal framework

Figure 11. Screenshot of the template completed for the PESTLE analysis of local ecosystem drivers of CS Sitia (as example): introductory part for the reflection on the vulnerable sectors, challenges and goals of the case study.

Below that, the complete PESTLE is included in a template form, with ideas and examples on each aspect of the PESTLE analysis to provide ideas and guidance to case study leaders and supporters on

how to fill it. Both ideas and examples provided can be seen in the following Table 10, and were also included in the Google Forms survey that was shared with the different Local Councils of Stakeholders in their languages.

Table 10. PESTLE ideas and examples provided on each aspect to guide case study leaders, supporters and Local Council members for the local ecosystem drivers' analysis.

PESTLE aspect	IDEAS	EXAMPLES
POLITICAL local drivers	• Specific policy that enables... • Urban city plans supporting... • Local authorities' willingness to... • Political context in favour of...	• *Urban city plan that promotes the development of new infrastructure* • *Land use plan that protects natural heritage areas* • *Tax to foreign products that promotes local commerce*
ECONOMIC local drivers	• Funding available to climate adaptation actions... • Business models developed to... • Existence of public or private financing mechanisms... • Financing institutions willing to invest in climate adaptation projects... • Wider local potential benefits (e.g., for local business) ...	• *Active promotion of local green employment* • *Promotion of the local production and industries (e.g., to post-process the resources generated in the area)* • *Local stakeholders investing in renewable energy systems*
SOCIAL local drivers	• Benefits for a wide (representative) sample of the society (promotion of equality) ... • Civil society organisations involved in... • Way to encourage behavioural change... • Immigration... • Gender equality... • (Green) work and employment... • Promotion of healthy lifestyles and well-being of the general population through...	• *Local NGO that promotes the efficient use of resources by raising awareness in the citizenship* • *Local public initiatives to decarbonise transport system*
TECHNICAL local drivers	• Innovative local solutions to... • Experience with innovative solutions that... • Local stakeholders working in innovative solutions to... • Pilot in place that test... • Proven positive impacts on...	• *ICT (information and communication technology) solutions deployed at local level (5G networks)* • *Local actors with focus on R&I (research and innovation) activities climate change adaptation/mitigation*
LEGAL local drivers	• Law in place in favour of... • Land-use policy/regulation that allows the deployment of... • Law that promotes something by taxing... • Law that allows to develop...	• *Protected areas with specific legal framework within the territory* • *Law that mandates to carry out an environmental impact assessment by activity* • *Legislation in force for gender equality and non-discrimination*
ENVIRONMENTAL local drivers	• Natural resources for the deployment of... • Optimal ecosystem to develop... • Contribution to adaptation of climate change through... • Contribution to the reduction of GHG emissions by... • Associated environmental/biodiversity co-benefits achieved by...	• *Warmer winters due to climate change that reduce the heating needs (energy consumption reduction)* • *Increase in the effectiveness of solar production in PV panels (more hours without clouds)* • *Approved project for the protection, conservation and further development of a forest in the area, which will contribute to the adaptation to climate*

PESTLE aspect	IDEAS	EXAMPLES
		change, improvement of air quality and other associated co-benefits

Below the introductory PESTLE part (Figure 11), the PESTLE itself was deployed, for each case study to include their local ecosystem drivers in each aspect (Figure 12). The template included the abovementioned ideas and examples to guide the formulation of drivers, as well as a cell at the right side that allows linking the driver with other aspect of the PESTLE, as sometimes they fall under more than one.

PESTLE:

POLITICAL local drivers		*Secondary aspect in PESTLE (if relevant)
IDEAS: - Specific policy that enables... - Urban city plans supporting... - Local authorities willingness to... / - Political context in favour of... **EXAMPLES:** - *Urban city plan that promotes the development of new infrastructure* - *Land use plan that protects natural heritage areas* - *Tax to foreign products that promotes local commerce*	• local and regional sustainable strategies	
	• all regions in Romania, including Tulcea county are supporters of the EU	
	• EU protected local gastronomic products (smoked Danube mackerel, pike roe salad and Dobruja pie)	
	• local authorities interested to access European funding to develop local strategies- climate change including	
	• existence of association forms between local authorities	
	• policies that support preservation of the wild beaches and virgin	
	•	
	•	

ECONOMIC local drivers		*Secondary aspect in PESTLE (if relevant)
IDEAS: - Funding available to climate adaptation actions... - Business models developed to... - Existence of public or private financing mechanisms... - Financing institutions willing to invest in climate adaptation projects... - Wider local potential benefits (e.g. for local business)... **EXAMPLES:** - *Active promotion of local green employment* - *Promotion of the local production and industries (e.g. to post-process the resources generated in the area)* - *Local stakeholders investing in renewable energy systems*	• national and local policies in real estate	
	• flexibility of the market towards new opportunities- proven during the covid -19 pandemic and the African pest epidemic	
	• Integrated Territorial Investment Instrument for local funded actions for ecological business models	
	• national policies successfully transposed on local level that support individual energy independence from renewable	
	•	
	•	
	•	
	•	
	•	

SOCIAL local drivers		*Secondary aspect in PESTLE (if relevant)
IDEAS: - Benefits for a wide (representative) sample of the society (promotion of equality)... - Civil society organisations involved in... - Way to encourage behavioural change... - Inmigration... - Gender equality... - (Green) work and employment... - Promotion of healthy lifestyles and well-being of the general population through... **EXAMPLES:** - *Local NGO that promotes the efficient use of resources by raising awareness in the citizenship* - *Local public initiatives to decarbonise transport system*	• capitalization of the local ethnical mosaic and environment initiatives in cultural actions - ethnic and green	
	• public partnerships with the local ecomuseum network to promote green practices	
	• people are more dedicated to sanction bad environmental practices	
	• growing number of green initiatives funded by the participatory governance instruments	
	• increased interest of the general community for healthy and wellness practices	
	• NoCar Fridays- green initiatives for the administration and	
	• immigrant workers in industry and tourism sector	
	• social inclusion strategy for all vulnerable categories	
	•	
	•	
	•	

Figure 12. Screenshot of the template completed for the PESTLE analysis of local ecosystem drivers of CS Danube Delta (as example): how the aspects of the PESTLE are depicted.

3. Case Study 1 – Island (Sitia, Crete) characterisation

The Municipality of Sitia is located on the island of Crete in Greece and it belongs to the regional Department of Lasithi. It covers the Eastern part of the island and has a surface area of 633.22 km^2 (Figure 13). The capital of the Municipality is also called Sitia, it is one of the two largest, most important cities of Lasithi. Public services which are located in urban areas include a port, an airport, schools, a university and a hospital. According to the latest population census of 2021[5] provided by the Hellenic Statistical Authority (ELSTAT), the population of the Municipality of Sitia reached 20,438 inhabitants, the majority of whom live in the capital (almost 78%) with the approximate population density of 57 inhabitants/km^2. The population in 2021 (20,438) has increased by 3.2% compared to 2011 (19,720), being 26% of the total population of the Lasithi region. Regarding their gender distribution, 50.3% are men while 49.7% are women, this gender distribution being constant over the time scale. The economy, has traditionally been based on agriculture although agricultural areas are often sparse due to the stony and mountainous terrain. Thanks to Government subsidies, the economy is growing as it is reflected in the GDP. The GDP of the regional Department of Lasithi, in which the Municipality of Sitia belongs to, in 2020 was 1.074 million € (normalised to the 2015 prices) corresponding to 14,591€ per capita[6] in 2020 and being lower than 10 year before (15,522). The efforts of local authorities on the promotion of development especially in the fields of agriculture, industry, commerce, construction and tourism is generating a more on less constant evolution of the GDP.

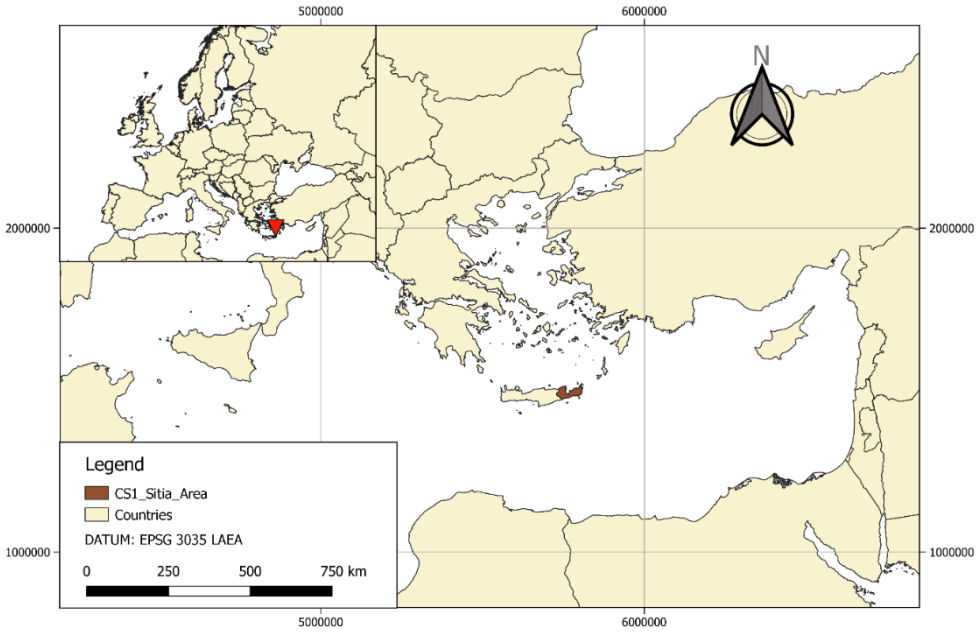


Figure 13. Location of CS1, Sitia municipality.

The Municipality of Sitia has established a holistic plan for the development and preservation of the natural and cultural environment and sustainable local development: The Sitia UNESCO Global Geopark. The Geopark occupies 517 km^2 of the total area of Sitia. It has implemented a series of informative infrastructure and accommodation facilities for its visitors with the aid of European funded programmes. Within its boundaries the wider area of the Municipality of Sitia (urban center and peri-urban areas), as well as the entire Municipal Units of Itanos and Lefki including all the coastal areas from North to South are included. Zakros, Palekastro, Ziros and Xerokampos are some of the best-

[5] https://www.statistics.gr/el/2021-census-res-pop-results
[6] https://www.statistics.gr/el/statistics/-/publication/SEL15/2021

known areas within the Geopark. Its boundaries start from the area of Mesa Mouliani and reach to Kavo Sidero and from Krya to Xerokampos.

In the area of the Geopark, impressive rocks have been identified, with special formations and landforms, composing a landscape of rich geo-heritage. The Geopark's management body is the Municipal Organization of the Municipality of Sitia (D.OK.A.S.). In 2015, the Sitia Geopark was added to UNESCO's World Geoparks list, renaming it "Sitia Global Geopark". The gateway is the town of Sitia, which can be accessed either via the provincial road Agios Nikolaos – Sitia – Palekastros or Agios Nikolaos – Ierapetra – Sitia, or via its port or by air from the Municipal Airport "Vicenzos Kornaros" (connection with Athens, Alexandroupolis, Rhodes and Preveza).

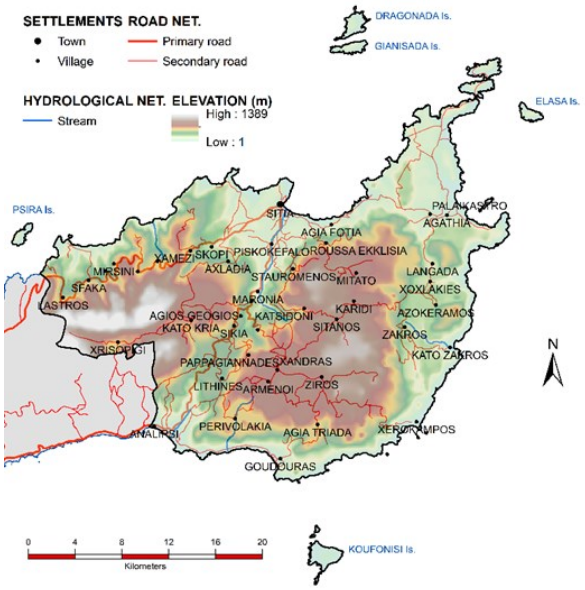


Figure 14. Topographic map of Municipality of Sitia with water streams. Source: Geospatial Information Infrastructure (GIS) of the Region of Crete[7].

The region of Sitia has very intense local scale weather patterns due to its highly complex topography and air-sea interaction. The highest altitude of Sitia Municipality is around 1,389 meters and the area exhibit a rich continuous pattern of altitude alternations throughout (Figure 14).

3.1. Analysis of geographical landscape and historical climate conditions

This section includes an analysis of the historical and future climate in the Sitia municipality and also the main sectors that will be affected by forecast changes in the climate due to the increase of emissions and the associated effects in social, economic and environmental systems.

3.1.1. Climate analysis and characterisation of vulnerable sectors

In this section, two relevant objectives are covered: (i) an assessment of the main climate data (temperature, precipitation and wind) in the historical (1985-2015) and future period (from 2023 to 2100) under two different climate scenarios for the Sitia municipality; and (ii) identification and description of the main assets per vulnerable sector that will be affected by future changes in the climate.

7 https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map7_loader_public&lon=2907892.2020578&lat=4184952.231875&zoom=11

3.1.1.1. Climate and weather analysis

Sitia is Europe's municipality most "extreme climate hotspot", mainly due to thermal drought conditions. Sustained high winds at the eastern part, and almost 300 sunshine days / year, with few rain events. The characteristics of climate extremes has been rapidly changing, recently the region observed "very fast" forest fires, intense cloudbursts, heavy thunderstorms that resulted in devastating flood events in the city of Sitia. The projected sea level rise in the up to 2100 is over 1m (JRC data) and storm surges will induce unexpected changes in the coastline due to coastal erosion (especially in southern coasts) that has been accelerated in recent years (Figure 15).

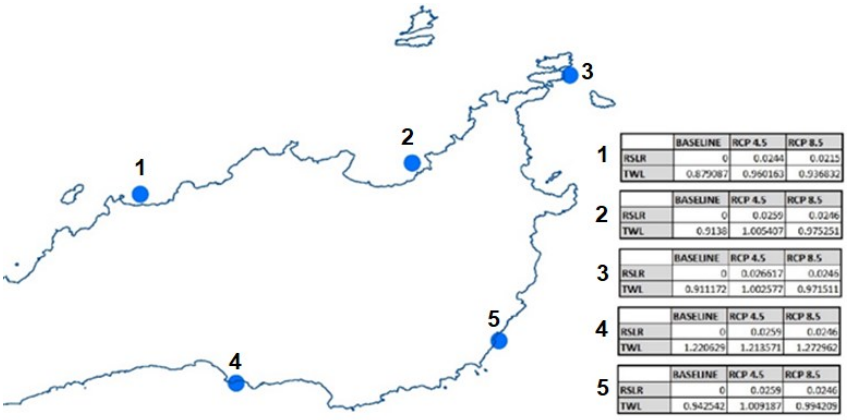


Figure 15. Sea level rise map for the Sitia case study.

Climate analysis is based on the Essential Climate Variable (ECVs). More in detail, the following variables are evaluated: maximum annual daily cumulated precipitation, mean annual daily cumulated precipitation, mean annual daily maximum temperature, mean annual daily minimum temperature, mean annual daily mean temperature and mean annual daily mean surface wind speed.

- **Temperature**

The results of future temperature simulation of the climate models for temperature identified as the mean annual daily temperature in Sitia (18.69ºC in the historical period) will increase according to the two considered climate scenarios. It is expected that the mean annual daily temperature increases by more than 5.5ºC in the most unfavorable scenario (SSP585) in the long term. In this sense, the temperature will increase more than 24.4ºC in 2100. Considering the minimum and maximum mean annual daily temperature, the same pattern is expected facing a warmer climate with very high temperature in extremes. Table 11 presents the temperature results in Sitia for two different scenarios (SSP245 and SSP585) and the comparison with the mean historical values.

Table 11. Mean, Maximum and Minimum temperature and related anomalies comparing with the historical values. Lighter red colour implies smaller changes while dark red implies higher changes.

Scenario and period		Mean temperature	Mean maximum temperature	Mean minimum temperature
Historical scenario		18.69	20,38	16,63
SSP245 scenario	**2023-2039**	19.97	21,92	17,87
	2040-2069	20.95	23,03	18,72
	2070-2100	21.94	24,23	19,64
SSP585 scenario	**2023-2039**	20.20	22,07	17,98
	2040-2069	21.63	23,79	19,29
	2070-2100	24.44	27,01	21,85

Anomaly SSP245 scenario	2023-2039	1.29	1.54	1.24
	2040-2069	2.26	2.65	2.09
	2070-2100	3.25	3.86	3.01
Anomaly SSP585 scenario	2023-2039	1.51	1.69	1.35
	2040-2069	2.94	3.41	2.66
	2070-2100	5.75	6.63	5.22

Figure 16 presents the results of the evolution of mean annual daily temperature along the period 2015-2100 using downscaled data from eight different climate models for the SSP245 climate scenario. The average value for the eight models under SSP245 is presented in Figure 17, where the confidence interval is represented by the maximum and minimum value of the set of models in each simulation year. The same representation for the temperature variation under SSP585 climate scenario is included in Figure 18 and Figure 19 respectively. Results show a high heterogeneity between model results and scenario with a growing trend along the evaluated period in both cases, being higher the temperature increase in the most extreme scenario (SSP585).

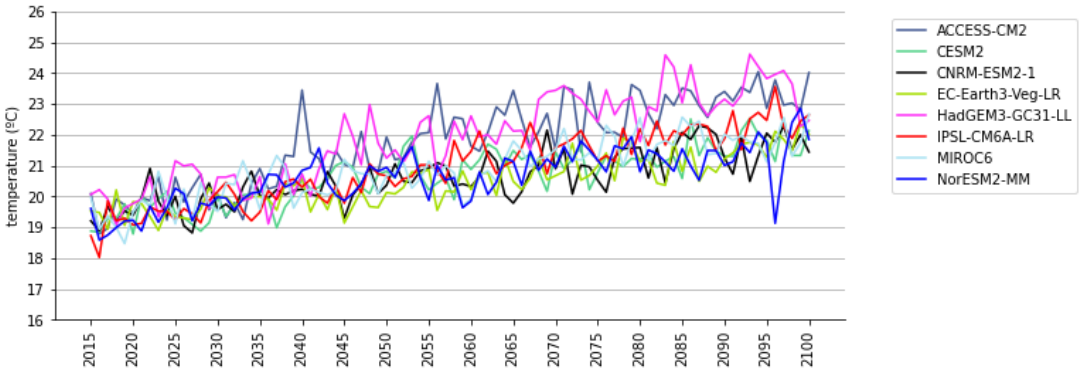


Figure 16. Mean annual daily temperature in the SSP245 scenario (2015-2100) for eight models in Sitia obtained by statistical downscaling procedure.

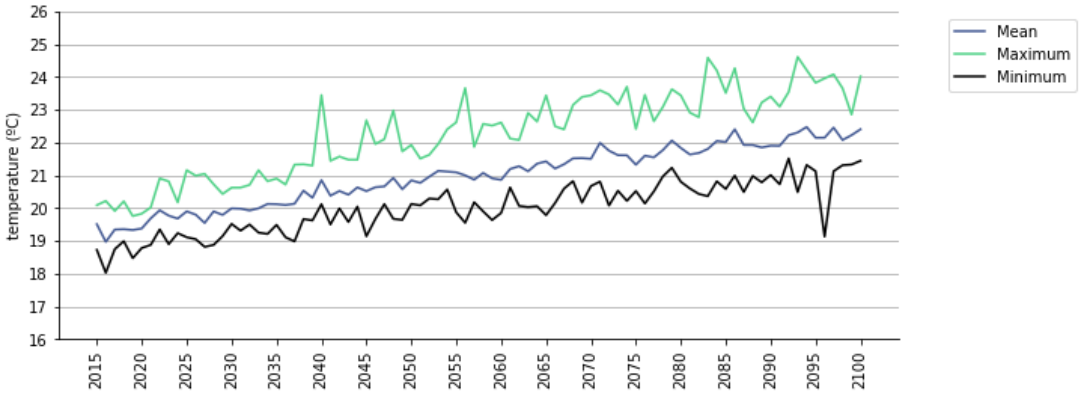


Figure 17. Ensemble mean annual daily temperate and range of variation (Maximum and Minimum) for a set of eight models in the SSP245 scenario (2015-2100) for Sitia.

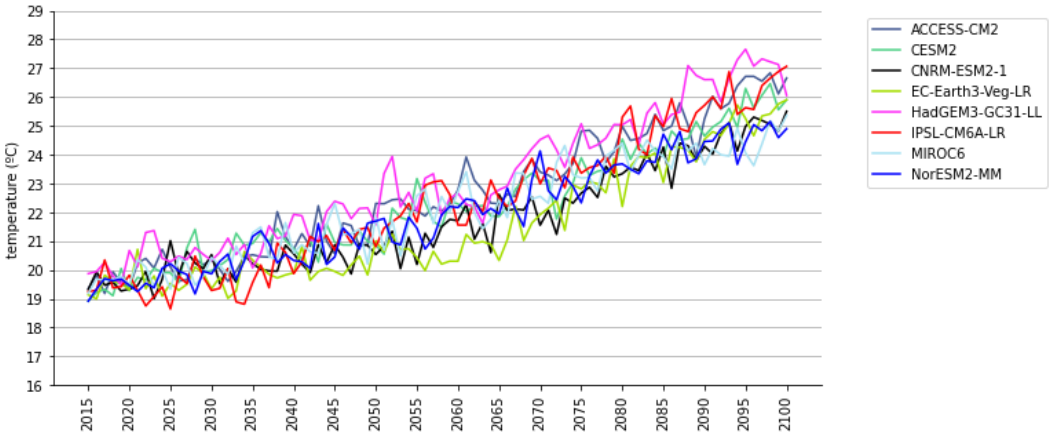


Figure 18. Mean annual daily temperature in the SSP585 scenario (2015-2100) for eight models in Sitia obtained by statistical downscaling procedure.

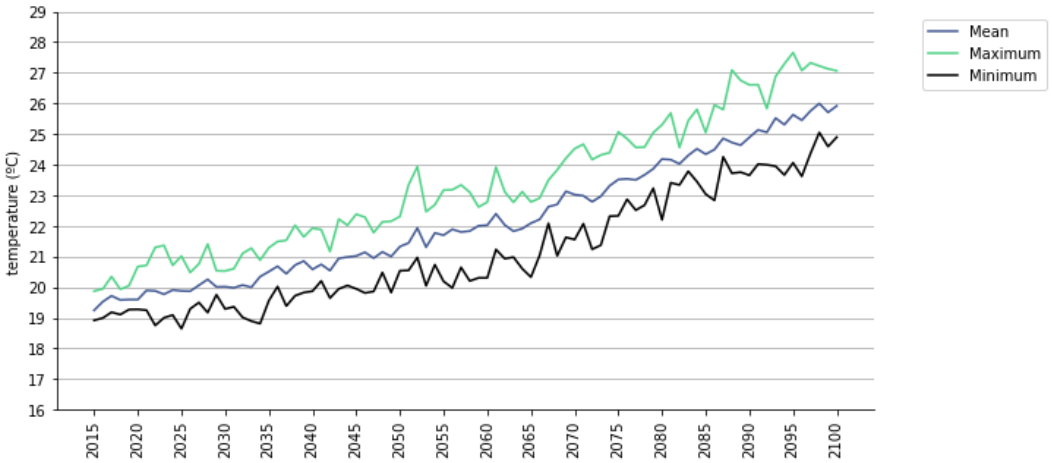


Figure 19. Ensemble mean daily annual temperate and range of variation (Maximum and Minimum) for a set of eight models in the SSP585 scenario (2015-2100) for Sitia.

○ Precipitation

The evolution of precipitation in the future shows a slightly increasing trend, which is the same to that observed for temperatures. Considering its evolution throughout the time periods analyzed (Table 12), the increase in precipitation will be more visible in the most unfavorable scenario (SSP585). The mean annual daily cumulated precipitation observed in the historical period is 4.28 mm/day, which is equivalent to an annual precipitation of 1562.2 mm. The results of the models for the future, forecast a raise in precipitation of up to 4.90% in the most unfavorable scenario. This increase will mean an average of 76.65 mm of precipitation per year. On the other hand, the maximum annual daily cumulated precipitation increases in all evaluated periods except in the long term in the most unfavorable scenario, where there is more uncertainty. This is representative of more torrential events.

Table 12. Mean and Maximum annual daily cumulated precipitation and related anomalies comparing with the historical. Lighter blue colour implies smaller changes while dark blue implies higher changes.

Scenario and period		Mean annual daily cumulated	Maximum annual daily cumulated
Historical scenario		1.02	35.40
SSP245 scenario	**2023-2039**	0.98	36.85

	2040-2069	0.94	37.03
	2070-2100	0.88	37.01
SSP585 scenario	**2023-2039**	0.95	36.71
	2040-2069	0.88	35.70
	2070-2100	0.73	35.64
Anomaly SSP245 scenario	**2023-2039**	-0.04	1.45
	2040-2069	-0.09	1.63
	2070-2100	-0.15	1.66
Anomaly SSP585 scenario	**2023-2039**	-0.07	1.31
	2040-2069	-0.15	0.30
	2070-2100	-0.30	0.24

Figure 20 presents the results of the evolution of the mean annual daily cumulated precipitation along the period 2015-2100 using downscaled data from eight different climate models for the SSP245 climate scenario. The average value for the eight models under SSP245 is presented in Figure 21 where the confidence interval is represented by the maximum and minimum value of the set of models in each simulation year. The same representation for the mean annual daily cumulated precipitation variation under SSP585 climate scenario is included in Figure 22 and Figure 23 respectively. The results by model have great heterogeneity, which is very visible in the figures for comparing the results of the models, where no clear trend is observed by model evaluating the precipitation results.

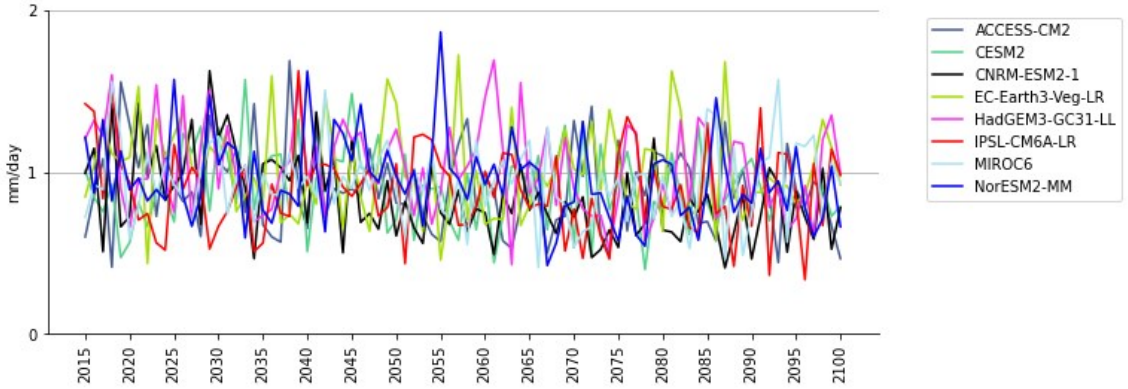


Figure 20. Mean annual daily cumulated precipitation in the SSP245 scenario (2015-2100) for eight models in Sitia obtained by statistical downscaling procedure.

Figure 21. Ensemble mean annual daily cumulated precipitation and range of variation (Maximum and Minimum) for a set of eight models in the SSP245 scenario (2015-2100) for Sitia.

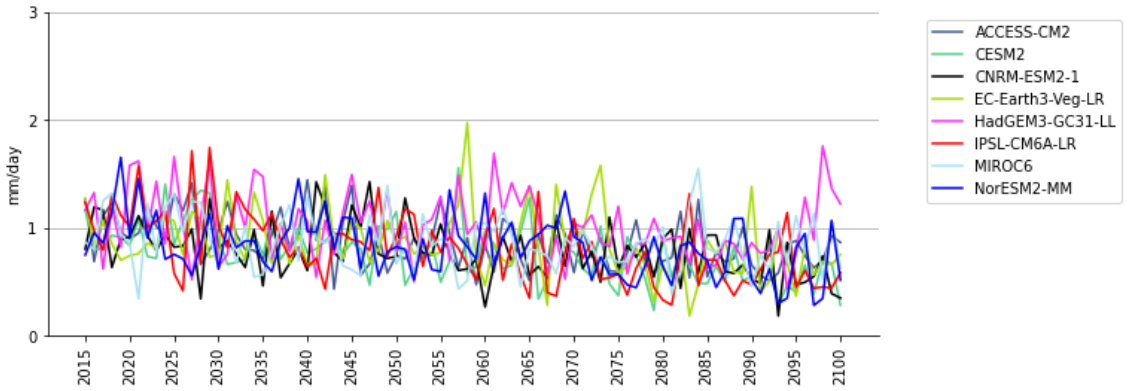


Figure 22. Mean annual daily cumulated precipitation in the SSP585 scenario (2015-2100) for eight models in Sitia obtained by statistical downscaling procedure.

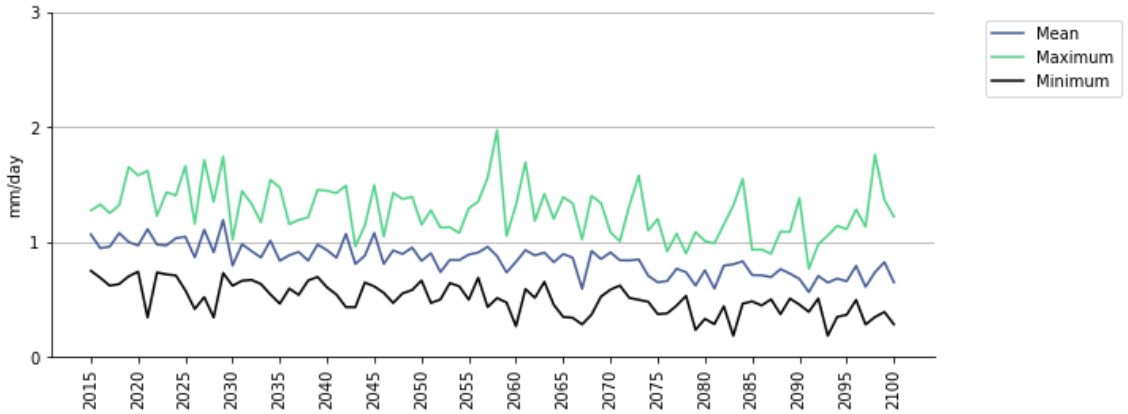


Figure 23. Ensemble mean annual daily cumulated precipitation and range of variation (Maximum and Minimum) for a set of eight models in the SSP585 scenario (2015-2100) for Sitia.

○ Wind.

Analysing the results of the two selected climate scenarios for the future to analyse the evolution of the mean annual daily wind speed in the Municipality of Sitia, a trend is observed that projects a small decrease in the average wind speed if we compare it with respect to the average value of the historical scenario (Table 13). These changes in wind speed are conditioned by the increase in temperatures, together with the roughness and sealing of the land surface. However, and despite the forecast decrease, the average value will not fall below 5.1 m/s even in the most unfavourable scenario (SSP585).

Table 13. Mean annual daily surface wind speed and related anomalies comparing with the historical.

Scenario and period		Mean annual daily surface wind speed
Historical scenario		5.42
SSP245 scenario	**2023-2039**	5.28
	2040-2069	5.21
	2070-2100	5.17
SSP585 scenario	**2023-2039**	5.25
	2040-2069	5.18
	2070-2100	5.08
	2023-2039	-0.14

Anomaly SSP245 scenario	**2040-2069**	-0.22 ↓
	2070-2100	-0.26 ↓
Anomaly SSP585 scenario	**2023-2039**	-0.17 ↓
	2040-2069	-0.23 ↓
	2070-2100	-0.34 ↓

Figure 24 presents the results of the evolution of the mean daily wind speed along the period 2015-2100 using downscaled data from six different climate models for the SSP245 climate scenario. The average value for the six models under SSP245 is presented in Figure 25 where the confidence interval is represented by the maximum and minimum value of the set of models in each simulation year. The same representation for the mean annual daily wind speed variation under SSP585 climate scenario is included in Figure 26 and Figure 27 respectively. It is observed in the figures for comparing the results that the NorESM3-MM model has wind results clearly lower than the others. It could be a consequence of the wind representation and hypothesis made in the model.

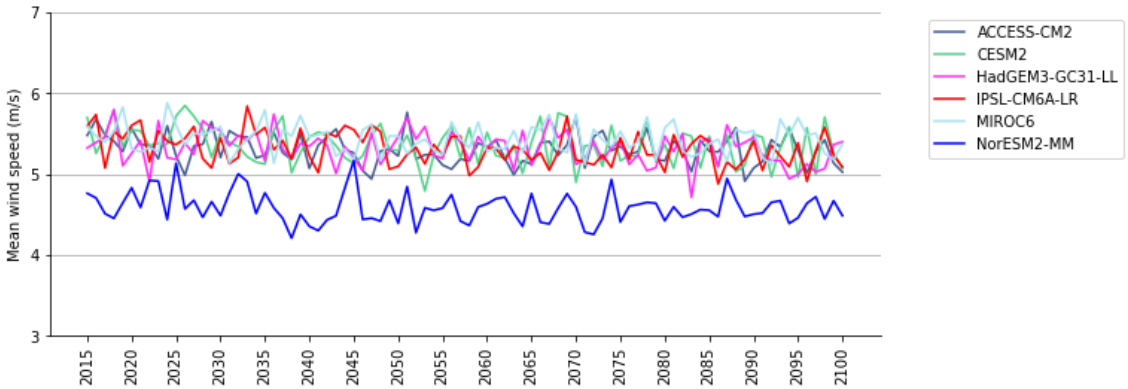


Figure 24. Mean annual daily wind speed in the SSP245 scenario (2015-2100) for six models in Sitia obtained by statistical downscaling procedure.

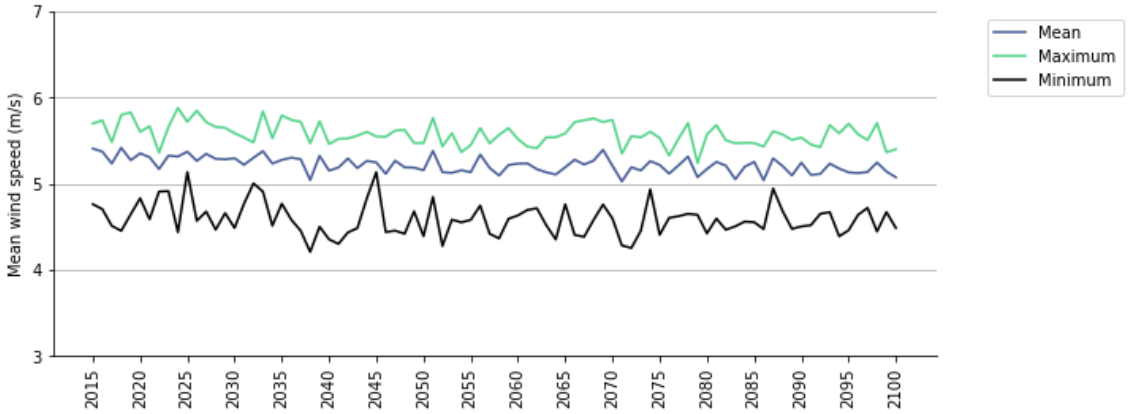


Figure 25. Ensemble mean annual daily wind speed and range of variation (Maximum and Minimum) for a set of six models in the SSP245 scenario (2015-2100) for Sitia.

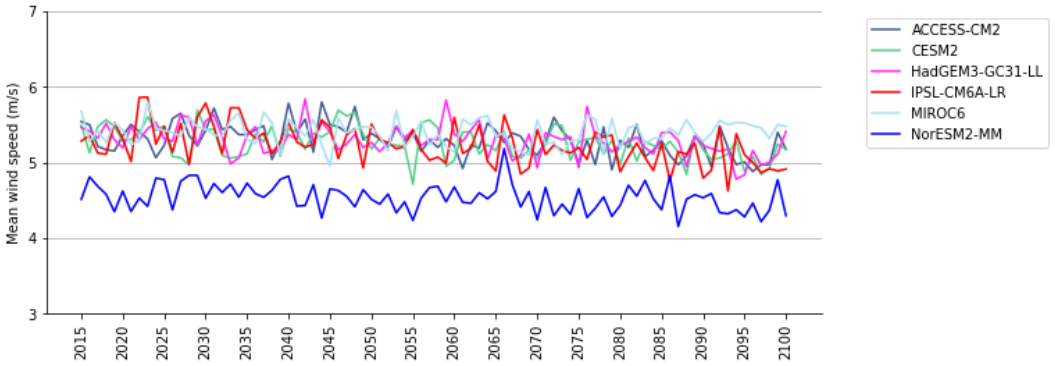


Figure 26. Mean annual daily wind speed in the SSP585 scenario (2015-2100) for six models in Sitia obtained by statistical downscaling procedure.

Figure 27. Ensemble mean annual daily wind speed and range of variation (Maximum and Minimum) for a set of six models in the SSP585 scenario (2015-2100) for Sitia.

3.1.1.2. Vulnerable sectors: identification of exposure assets

As introduced in section 2.1.1.2, the key vulnerable NEVERMORE sectors for Sitia case study are agriculture, forest and fishing, water and waste and biodiversity and natural heritage for a high-level priority, and with a lower level, the tourism, leisure and cultural heritage sectors. This was agreed with case study leaders in the first consultation (internal) as contrast exercise with the challenges and vulnerable sectors identified at proposal stage. The activity consisted on an online Jamboard in which the CS leaders identified their main challenges, to then relate them with the affected sectors and priorities for each of them (Figure 28).

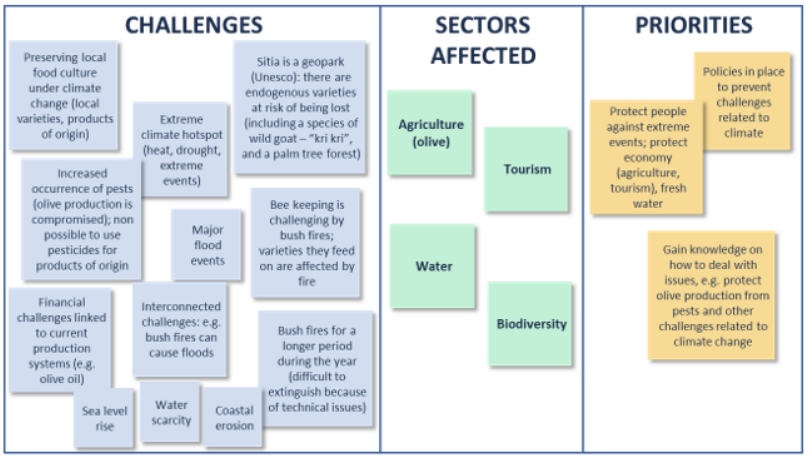


Figure 28. Results of the consultation with case study leaders on the challenges, related sectors affected and priorities.

Then, the first consultation with the Local Council of Stakeholders was held, and a similar activity to confirm the selection and heard other voices on this was performed. During this activity (developed the 22nd February 2023 in an in-person workshop) the stakeholders confirmed that heatwaves, floods, droughts, wildfires and coastal erosion and added landslides were the main climate hazards of the region. Regarding the sectors, tourism, agriculture, biodiversity and water resources were confirmed, and coastal areas was additionally identified (coastal areas characterisation is included in the characterisation of the water and tourism sectors, depending on the hazard relation).

The stakeholders also wanted to highlight the effects of the identified hazards to the "human life", since there have been some fatalities due to some of the hazards affecting the area e.g., landslides. The result of this citizen-driven risk analysis can be provided as a heatmap. A comment worth highlighting, that sparked a lively conversation in the room, was about the increase in sea surface temperature and the effects of this phenomenon that the local population has observed on the biodiversity and on the balance of fish populations and other endogenous species.

At the end, vulnerable sectors for the case study of Sitia were identified based on the analysis of historical events, the detailed overview of documents presenting the policies and development plans for the region (including the Regional Plan for Adaptation to Climate Change in Crete and the Sustainable Energy Action Plan of the Municipality of Sitia) and the feedback received from the Stakeholder members of the Local Council of Sitia.

○ Agriculture, forestry and fishing

All the land areas of Sitia Province, the valleys, the hills and the foothills of the mountains are cultivated, while the rest of the land, the slopes of the mountains, the forests of heather and wild olive, those covered with aspalathus, sage, thyme and others aromatic plants land surfaces host and feed thousands of goats and sheep in "free pasture" herds (Figure 29). Small or large "clusters" of beehives are established in suitable shrub and wildflower habitats. The majority of the population of the province are farmers: olive growers, vine growers, vegetable growers in greenhouses or open spaces, livestock breeders or beekeepers, while in the coastal villages and the city of Sitia there are fishermen. However, trends indicate a movement from rural communities towards urban environments, especially for the younger generations. The majority of rural life in some cases remains traditional, but there are also modern farmers with machines and modern processing and packaging facilities that allow the mass production and standardization of agricultural products. The province's economy is based on primary agricultural production with little yield due to the stony nature of its soil[8].

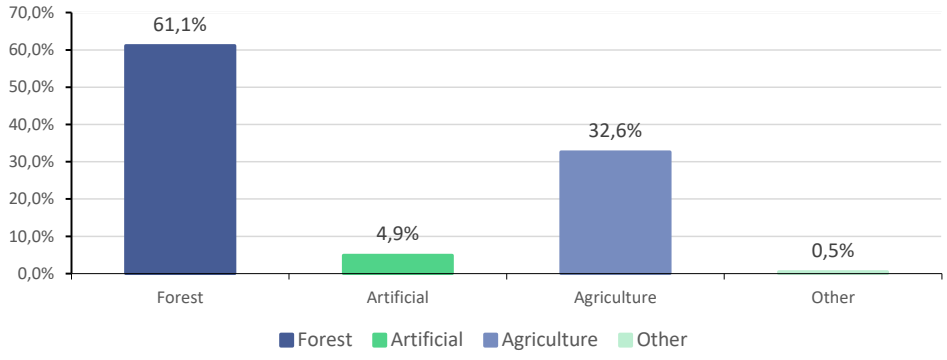


Figure 29. Percentage of area by use. Source: Geospatial Information Infrastructure (GIS) of the Region of Crete[9].

[8] https://www.crete.gov.gr/wp-content/uploads/2023/03/%CE%9C%CE%B5%CE%BB%CE%AD%CF%84%CE%B7-%CE%A0%CE%95%CE%A3%CE%A0%CE%9A%CE%91-%CE%91%CF%8D%CE%B3%CE%BF%CF%85%CF%83%CF%84%CE%BF%CF%82-2022.pdf

[9] https://gis.crete.gov.gr/sdi/?tab=viewport_mapgallerytab

Agriculture and livestock hold a dominant place in the employment of the citizens of Sitia, even though it faces great limitations due to the strong dependence on traditional methods and techniques, inadequate infrastructures, largely obsolete production systems and low post-production added value. A decrease in the number of employees in this sector from the years 2007 until 2013 was observed, due to a wide abandonment of vineyard farming and a continuous drop in the prices of olive oil, some fruits and vegetables (Figure 30). After 2013, a significant increase in employment in agriculture and livestock farming was recorded, as a compensation for a great number of job losses in other sectors.

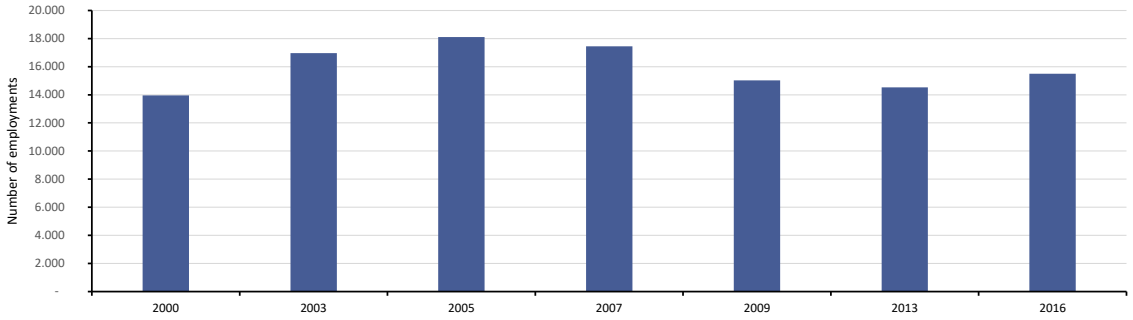


Figure 30. Evolution of the number of total employments in the agriculture and livestock sector. Source: Hellenic Statistical Authority[10].

Despite all difficulties, the economy of the area has been traditionally based on agriculture, with 32.6% of land in Sitia Municipality used for this purpose (Figure 29), although production can often be sparse due to the stony and mountainous terrain of Sitia. The largest percentage of agricultural land, around 53%, concerns tree crops (Figure 31), mainly olive groves together with citrus fruits, pome fruits, stone fruits and nuts (Figure 32 and Figure 33).

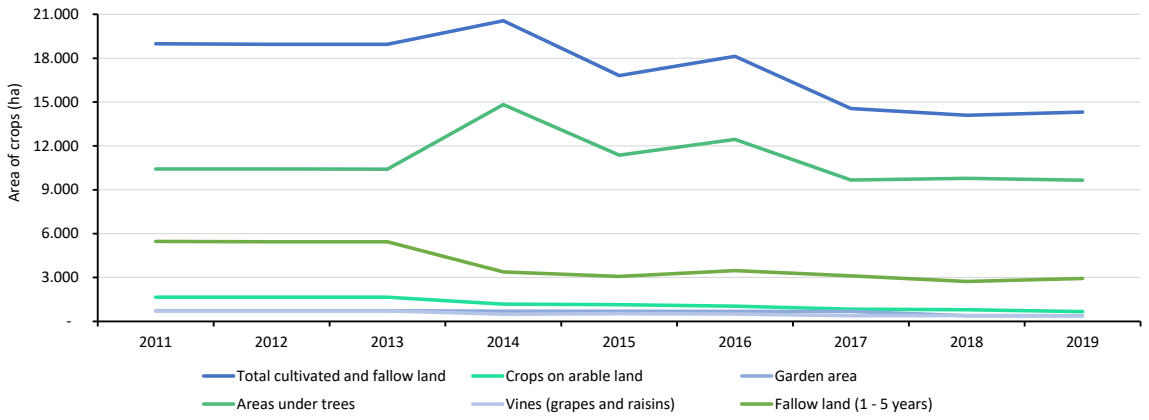


Figure 31. Evolution of categorized crop areas. Source: Hellenic Statistical Authority[11].

[10] https://www.statistics.gr/el/statistics/-/publication/SPG11/
[11] https://www.statistics.gr/el/statistics/-/publication/SPG06/

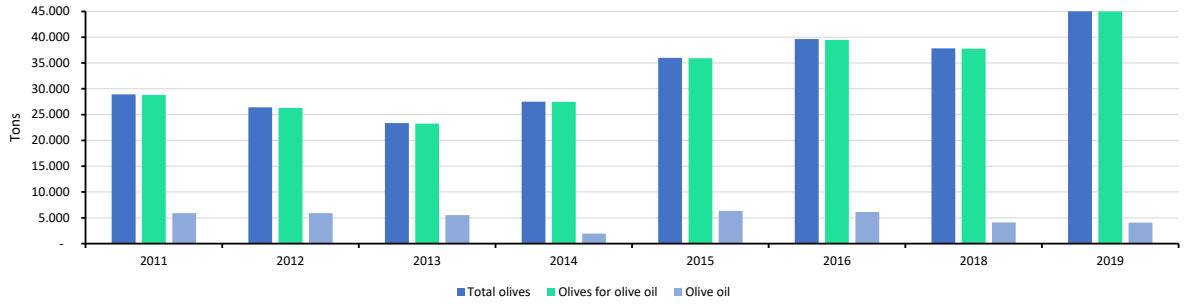


Figure 32. Evolution of the olive production. Source: Hellenic Statistical Authority[12].

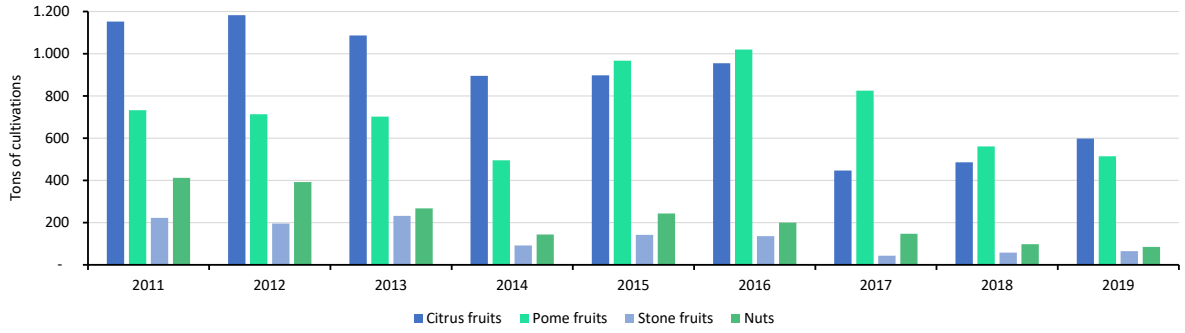


Figure 33. Evolution of the tree production for principal tree cultivations. Source: Hellenic Statistical Authority[13].

The arable lands, including large-scale crops, greenhouses and fallow land, corresponds to 42.1% of the land used for agriculture in Sitia Municipality, with wheat, oats and barley crops occupying the largest part (Figure 34 and Figure 35). Finally, vineyards and grape vine crops correspond to just 6% of agriculture land in the region.

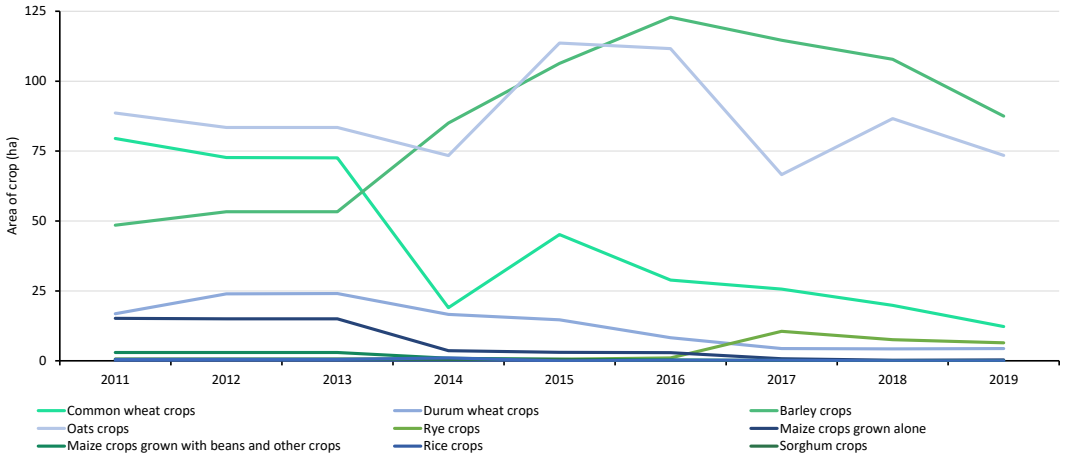


Figure 34. Evolution of crops on arable lands (Cereals for grain). Source: Hellenic Statistical Authority[14].

[12] https://www.statistics.gr/el/statistics/-/publication/SPG06/
[13] https://www.statistics.gr/el/statistics/-/publication/SPG06/
[14] https://www.statistics.gr/el/statistics/-/publication/SPG06/

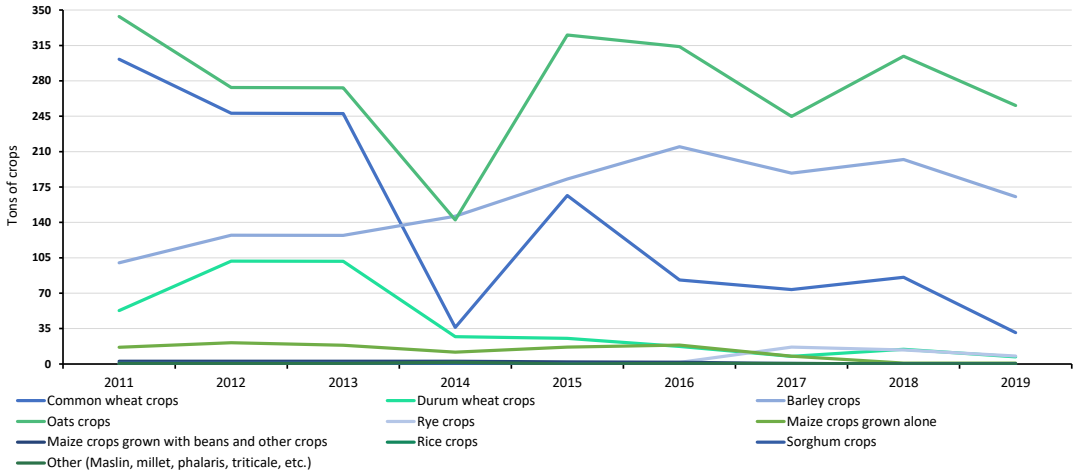


Figure 35. Evolution of the production of different crops. Source: Hellenic Statistical Authority[15].

According to the LIFE Adapt2Clima project, the crops most likely to be affected from the effects of climate change in Sitia are vines and olives due to the water scarcity. This will have a serious impact on the economy of the region since on one hand the wines of Sitia have been famous since ancient times and today are considered to be of excellent quality and therefore are sold in the domestic and foreign markets. On the other hand, the olive oil of Sitia is one of the best in the world. It is extra virgin with Designation of Origin of Superior Quality, it is controlled according to HACCP and ISO 9002 and for several years it has won first prizes in the international competitions it participates in. In 2020 it won the first World prize in the competition for extra virgin olive oils of the International Olive Oil Council (which is a UN institution).

Livestock farming is quite scattered with only just a few organized livestock farms and entails raising mainly poultry, sheep, goats, rabbits, pigs and cattle (Figure 36 and Figure 37). Apiculture is also a leading occupation in this particular sector (Figure 37). Beekeeping for the production of honey has its roots deep in history and the morphology of the region with its stony soil and fragrant herbs give the honey produced in Sitia unique properties and aromas. For this reason, financial support is provided to beekeepers and producers to support both traditional methods, as well as a shift towards organic practices.

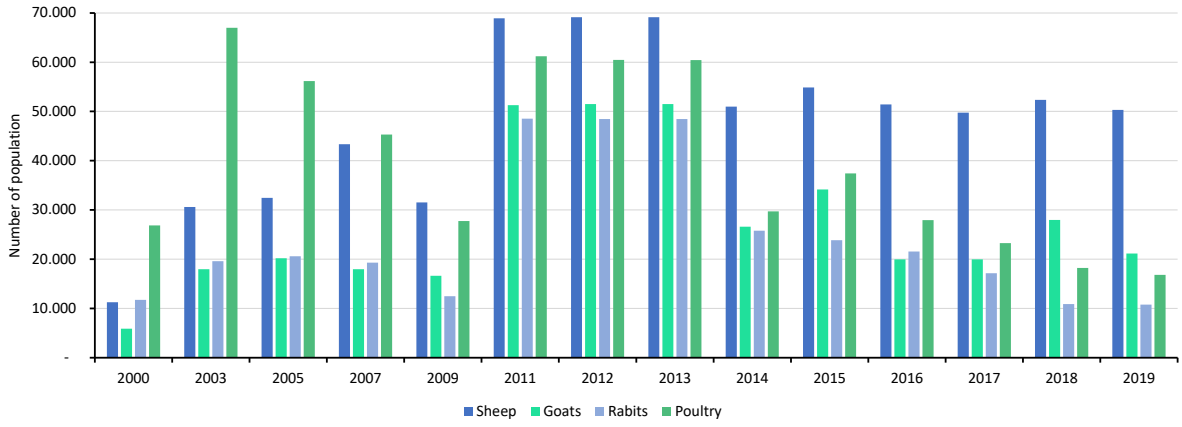


Figure 36. Evolution of the livestock animals by kind. Source: Hellenic Statistical Authority[16].

[15] https://www.statistics.gr/el/statistics/-/publication/SPG06/
[16] https://www.statistics.gr/el/statistics/-/publication/SPK33/-

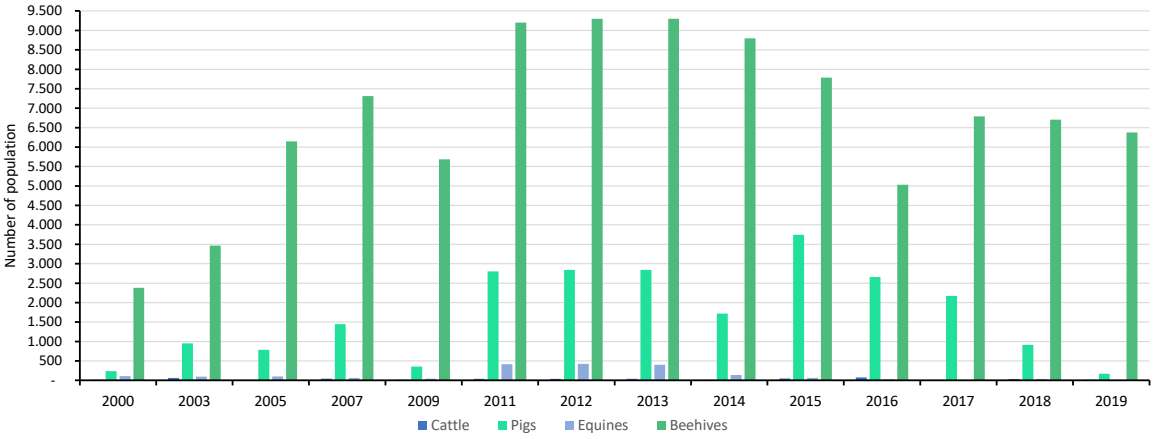


Figure 37. Evolution of the livestock animals by kind (continued). Source: Hellenic Statistical Authority[17].

Studies have been performed regarding the vulnerability of the sector of agriculture and livestock farming due to climate change in the region of Sitia in the coming years[18]. More specifically, climate changes that most probably will affect the sector include the increase in temperature, the lengthening of dry periods (droughts), the decrease in precipitation, the increase in the intensity and frequency of flooding phenomena, the intensity and duration of the exposure to solar radiation and sea level rise in coastal agricultural lands. These climate hazards will most likely lead to a decrease in annual agricultural production (harvest), a decrease in soil fertility and a shift to crops that require longer vegetative periods and less water. In addition, in the case of increased temperatures the quality of olive oil will severely worsen, and vine crops face the danger of complete eradication. Also, an increase in pests and diseases depending on the type of crop is quite likely. Regarding livestock, an increase in production cost will most likely emerge due to limitations in the availability of animal food. In addition, there will be a lack of water to cover the needs of livestock production and a high risk of disease occurrence, increase of pests and pest infestations, as well as a negative impact on the survival rates of animals and reproductive success due to flooding events, prolonged droughts and extreme temperatures.

○ Water and waste

Sitia is the European region most exposed to climate pressures, mainly heat and droughts. This situation exerts pressures on freshwater levels especially during summer periods due to tourism and agriculture. It could be exacerbated with long drought periods and sudden precipitation downbursts. Thus, a main challenge for the region is to maintain sufficient and sustainable freshwater resources, of high environmental quality. The existing water supply networks (Figure 38) have numerous problems, with the most severe of them related to improper maintenance due to very high costs. The replacement of the old networks that have been built using cement pipes and their upgrade is a big need for the region, since the water supply suffers from leakage caused by rupture of the pipes or from blockages caused by a build-up of salt from brackish water. The needs for irrigation in the region are very large, to support agriculture and the high-water demand cultivation systems and farms.

[17] https://www.statistics.gr/el/statistics/-/publication/SPK11/-

[18] https://www.crete.gov.gr/wp-content/uploads/2023/03/%CE%9C%CE%B5%CE%BB%CE%AD%CF%84%CE%B7-%CE%A0%CE%95%CE%A3%CE%A0%CE%9A%CE%91-%CE%91%CF%8D%CE%B3%CE%BF%CF%85%CF%83%CF%84%CE%BF%CF%82-2022.pdf

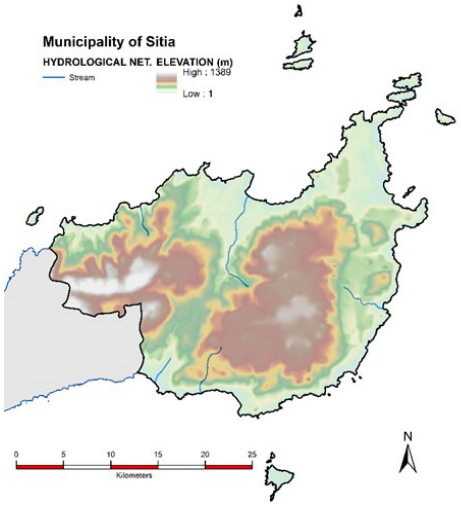


Figure 38. Topographic map of Municipality of Sitia with water streams. Source: Geospatial Information Infrastructure (GIS) of the Region of Crete[19].

There are various irrigation projects in the regional department of Lasithi and one of the two most important one is that of the city of Sitia. In the Municipality of Sitia, five main and functional irrigation projects can be found. It is important to mention that a lot of studies are being conducted to evaluate several more sites throughout the Municipality for the construction of new irrigation projects in order to promote development in the region and transform barren lands into arable ones. Water consumption by region inside Crete inland is available in Figure 39.

Responsible for irrigation are the Local Organizations Networks (Τοπικοί Οργανισμοί Εγγείων Βελτιώσεων - TOEB). Table 14 shows the irrigated area and the amount of water moved annually for those TOEB who provided data for the year 2012, for the preparation of the River Basin Management Plan of the Water Division of Crete. Water consumption by permanent population is presented in Table 15, while water consumption by non-permanent population in presented in Table 16. Finally, the total water consumption in irrigation per crop type is presented in Table 17.

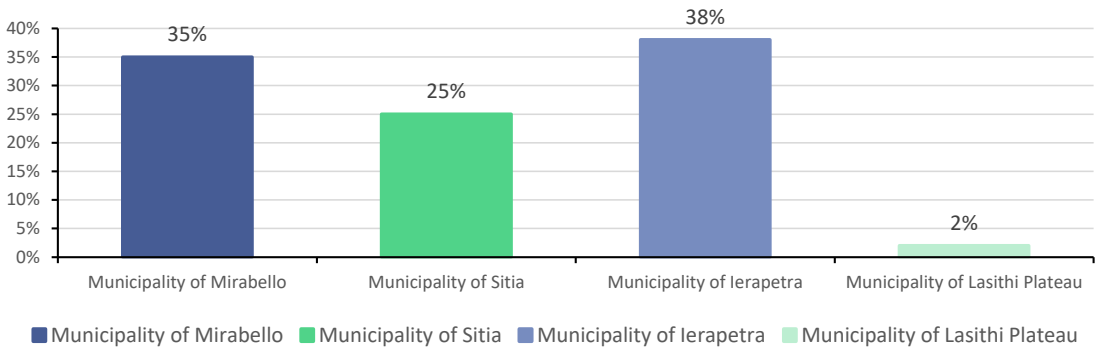


Figure 39. Water consumption of region of Lasithi. Source: dspace website[20]

[19] https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map7_loader_public&lon=2907892.2020578&lat=4184952.231875&zoom=11

[20] https://dspace.lib.ntua.gr/xmlui/bitstream/handle/123456789/3487/bourav_crete.pdf?sequence=3

Table 14. TOEB of Municipality of Sitia. Source: aquaman website[21]

	TOEB	Irrigated area (ha)	Annual amount of water transported (m^3)
Municipality of Sitia	Sitia – Piskokefalo	830	700,000
	Papagianadon	653	589,600
	Zakrou	N/A	1,890,631

Table 15. Water Consumption of the permanent population in 2010. Source: dspace[22]

Municipality of Sitia	Population	Consumption/person (m3/year)	Total consumption (m3/year)
	19,569	100	1,956,868

Table 16. Water consumption of Non-resident population. Source: dspace[23]

Municipality of Sitia	Consumption of the region of Lasithi (m^3/year)	Percentage	Consumption of the Municipality (m^3/year)
	1,093,485	20%	218,697

Table 17. Water consumption for irrigation of the Municipality of Sitia. Source: dspace[24]

Consumption (m^3/stremma)				Total consumption (m^3/km^2)			
Vineyards	Fruit-bearing trees	Olive groves	Other crops	Vineyards	Fruit-bearing trees	Olive groves	Other crops
280	490	220	250	2,149.66	283.02	22,997.62	6,812.53

▪ SITIA-PALAIKASTRO HYDROGEOLOGICAL SYSTEM

This karst system is located at the easternmost end of Lasithi Prefecture and covers the water and irrigation needs of the region, with significant potential beyond tourism development. For this reason, it is a particularly important aquifer. Because of its hydraulic relationship with the sea, its continuous monitoring is required in order to avoid its degradation (Region of Crete, 2009). The main urban areas of the basin are those of Zakros and Palaikastro. The crops that cover the wider hydrogeological system are mainly olive groves, while in the southern part we have permanently irrigated land according to Corine's classification. The absence of dense vegetation and generally forested areas is obvious.

Considering the importance of this body of water, at the beginning of 2008 the Prefectural Administration of Lasithi installed a monitoring station at Palekastro in Sitias, at a point close to the productive wells of the area. In the diagram below (Figure 40), the stable and very good quality of the aquifer's water can be seen, but the downward trend of its water level can also be seen. A characteristic worth noting is the amount of rainfall, which for the hydrological year 2008-2009 was only 235 mm. The hydrogeological basins of Palaikastro-Siteia, which are considered particularly important since they cover the irrigation, water supply and tourism needs of the wider region, are in a fairly good chemical condition, with perhaps the only drawback being their quantitative variation[25].

[21] https://aquaman.tuc.gr/images/users/sotiria/%CE%A0%CE%B1%CF%81%CE%B1%CE%B4%CE%BF%CF%84%CE%AD%CE%BF_1.pdf
[22] https://dspace.lib.ntua.gr/xmlui/bitstream/handle/123456789/3487/bourav_crete.pdf?sequence=3.
[23] https://dspace.lib.ntua.gr/xmlui/bitstream/handle/123456789/3487/bourav_crete.pdf?sequence=3
[24] https://dspace.lib.ntua.gr/xmlui/bitstream/handle/123456789/3487/bourav_crete.pdf?sequence=3
[25] https://dspace.lib.ntua.gr/xmlui/bitstream/handle/123456789/8444/kalesm_water.pdf?sequence=

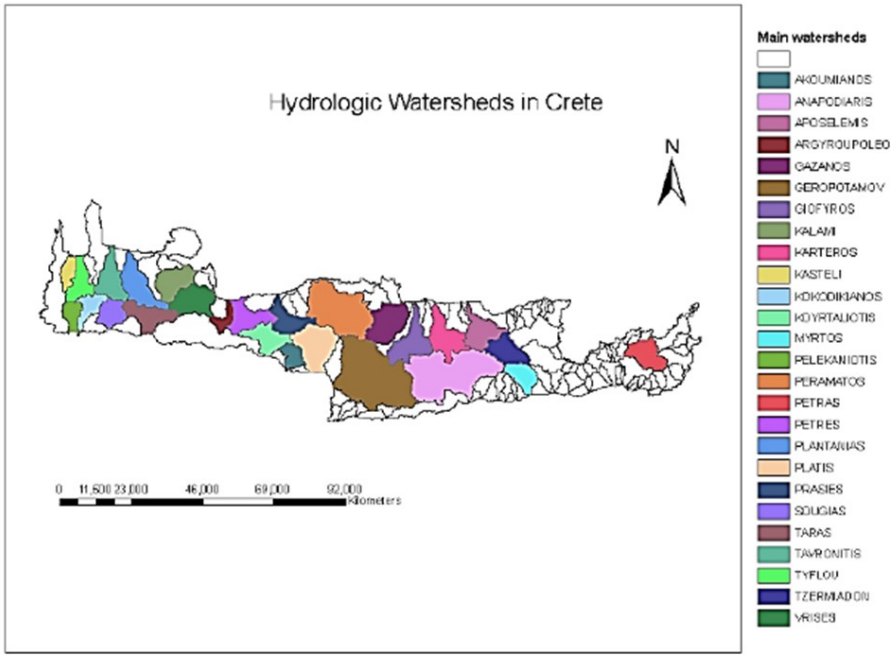


Figure 40. The most important hydrologic basins of Crete. Source: MEDIWAT. State of the Art of Water Resources in Mediterranean Island[26]

Despite the overall water sufficiency of Crete, there are regions (Messara valley, Sitia area) that experience severe water shortages, especially during the summer period, due to increased residential and agricultural needs. The intensive exploitation of groundwater, particularly by agricultural activity over the last 50 years, has led to a continual decline in the groundwater level, while several coastal aquifers suffer from seawater intrusion. In addition, the water quality of some aquifers has been degraded due to pollution from agricultural, industrial, and touristic activities. In a recent investigation of 91 aquifers in Crete, it was found that nine systems (one in Ierapetra-Sitia) had significant or moderate degradation due to elevated salinity and high NO_3- and SO_4- concentrations. Moreover, by applying a new groundwater footprint methodology, eleven aquifer system in Sitia also exhibited elevated rates of deterioration. Figure 41 shows the pumping per sub-basin. One of the largest volumes of pumping takes place in Patelis basin (Sitia) with a drainage basin of 84.57km^2.

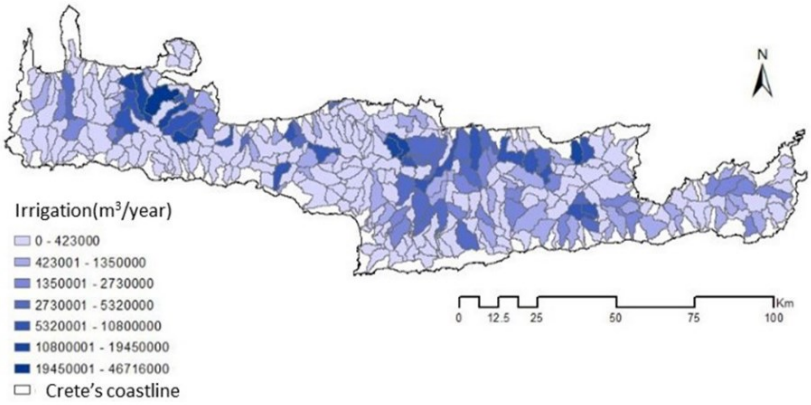


Figure 41. Pumping in Crete per sub-basin. Source: aquaman website[27]

[26] http://www.mediwat.eu/sites/default/files/D.3.1.1.pdf

[27] https://aquaman.tuc.gr/images/users/sotiria/%CE%A0%CE%B1%CF%81%CE%B1%CE%B4%CE%BF%CF%84%CE%AD%CE%BF_1.pdf

The sewage treatment and disposal facility of the city of Sitia (EEL) is located in the area "Exo Fanari - Bonda" and at a distance of approximately 1.5 Km from the city of Sitia. The facility was designed and built to meet the needs of the next 20 years, to serve a maximum equivalent population of 20,000 inhabitants. The EEL was designed for two phases of operation: The A' phase which concerns today's conditions (13,000 equivalent population) and the B' phase which concerns according to the specifications in the year 2016 (20,000 equivalent population). The facility also receives a quantity of domestic sewage from areas not connected to the sewer network. The treatment method prescribed by the Technical Specifications is the Activated Sludge system with extended aeration (Extended Aeration) with simultaneous full stabilization of the sludge and biological removal of nitrogen and phosphorus[28].

Risk assessment and vulnerability analyses regarding the effects of climate change on water resources of the region of Sitia have primarily identified an impact on the availability of water reserves and a significant degradation of their quality[29]. It is very important to note that, due to the fact that water resources and their quality are essential for various other sectors, for example agriculture, livestock farming, industry, tourism among others, concerns are raised related to the potential secondary impacts a wide range of important activities for society, extending to several sectors of the economy.

In greater detail, the climate hazards identified that could potentially affect water resources in Sitia were:

- The increase in temperature and by extension the increase of the effect of evapotranspiration
- A decrease in precipitation
- The lengthening of drought periods
- The increase of the intensity of rainfall and the frequency of flooding events
- Sea level rise in coastal aquifers

The decrease in rainfall and increase in evapotranspiration are expected result in the decrease of water supply and of the renewal process of aquifers (and therefore reduction of water reserves). Also, the increase in volume of rainfall and flooding events will result in surface run-offs, reduced penetrability and therefore a significant limitation of in water storage capacity of aquifers. This will progressively lead also to a qualitative degradation of underground aquifers due to the reduction of their water reserves. Aggravation of the desertification phenomenon is expected, due to the water deficit that will be created, together with a possible increase in the cost of water extraction due to the expected increased demand and a compromise of the citizens' quality of life due to potential restrictions on water use. Finally, an increase in algae growth is expected that will lower the quality of the water and lead to a need for additional processing to avoid transmission of diseases transmitted through the water and any further health and safety issues.

○ Biodiversity and natural heritage

Sitia's Geopark is one of the most important environmental areas of the Mediterranean. Its abiotic and biotic environment alternates through various elements and is a unique place with important geomorphological peculiarities. The dry-thermal climate of the area created habitats and ecosystems some of which are unique in the entire Mediterranean. Its geographical location also contributed to this since it allowed the exchange of species with Asia Minor.

The ecosystems that prevail in the area are thickets of phrygana and aromatic plants, whereas acorns, sycamores and carobs can be found mainly in gorges and ravines. Large forest ecosystems (or stands

[28] http://www.deyasitias.gr/viologikos-katharismos/e-e-l-siteias

[29] https://www.crete.gov.gr/wp-content/uploads/2023/03/%CE%9C%CE%B5%CE%BB%CE%AD%CF%84%CE%B7-%CE%A0%CE%95%CE%A3%CE%A0%CE%9A%CE%91-%CE%91%CF%8D%CE%B3%CE%BF%CF%85%CF%83%CF%84%CE%BF%CF%82-2022.pdf

of trees) do not occur, except for the "Finikodasos Vai Lassithiou" with a total area of 20 ha. Actually, Vai is the only Aesthetic Forest of Crete. It is located at the eastern end of Crete in the Municipality of Sitia next to the sea, to the north of the Palekastro settlement and at a distance of about 20 km from the city of Sitia. The reason for its inclusion in the category of aesthetic forests is the existence of the Cretan endemic *Phoenix theophrastii*, one of the two native palm species in Europe. In this forest, the largest number of *Phoenix theophrastii* palms that exist in Crete can be found. There are approximately 10 more locations on the island that scattered palm trees of that species can be found, but they do not constitute a forest.

- FLORA

The area of the Geopark (Figure 42) is of considerable floral interest. It hosts hundreds of plant species, many of which are endemic to Crete and Kasos, as well as unique species that only appear in the southeastern Aegean. The dominant vegetation is the bryophyte. Exceptions are found around the Finikodas area and in the gorges, especially during the months with a strong presence of water.

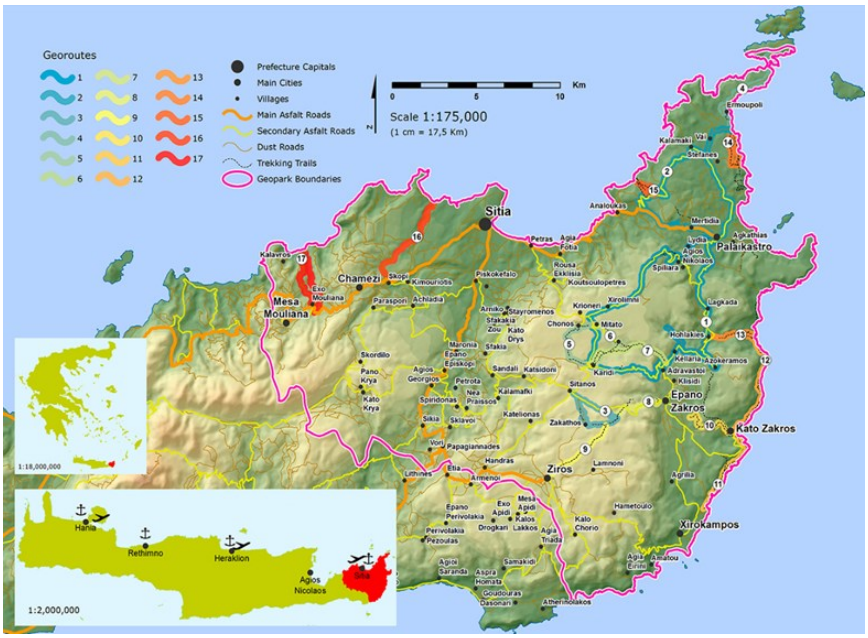


Figure 42. The Sitia UNESCO Global Geopark's map. Source: www.cretesitia.gr[30]

In the phrygana, both in the coastal and in the mountainous zone, low, spiny, and spherical shrubs dominate, such as astoibida, thyme, sea urchin, thrimpa and milkweed. Still non-thorny shrubs such as heather, *Ballota acetabulosa*, sage and larkspur are present. In smaller areas there are taller bushes that form the macchia vegetation and consist of skins, aspalathus, wild olives, junipers, holly, carob, *Osyris alba*, oleanders, and plums. In the ravines of the area of Zakros where the presence of water is abundant, plane trees, oleanders and ligaria grow.

The canyons of the area are a refuge for many important species of flora of the area. Especially the gorge of Kato Zakros and Chochlakia are home to a large number of plants. Characteristic species that live on the vertical limestone rocks and in the bed of the streams are *Aristolochia cretica*, *Delphinium staphisagria*, wild carnation, *Euphorbia dendroides*, *Lecokia cretica*, *Ephedra cambylopoda*, *Nepeta melissifolia*, capers, *Dracunculus vulgaris*, bellflowers, gorse, oregano, *Tulipa saxatilis* and many species of orchid. In the coastal areas, exclusively herbaceous plants appear, dominated by amaranth

[30] https://www.cretesitia.gr/index.php/el/natural-beauty-resources-of-sitia/sitia-nature-park

and the endemic *Limonium sitiacu*, while on the beaches of Katsounaki and Argilo Xerokampou, the sea lily also thrives.

- FAUNA

The area of Sitia, due to its special geographical location, hosts a large number of the characteristic animals of the island and especially migratory birds. Twenty of the bird species that have been observed in the area (migratory, endemic) are in the Red Book of threatened Vertebrates of Greece[31]. In the coastal areas, birds such as the white heron, the artemis, the cormorant, the merganser, the tern, the white-headed gull and the red-headed tern can be found. Of the predatory and scavenging birds, the most characteristic are the black petrel, the golden eagle or vichila, the peregrine falcon, the hawk, the kestrel, the griffon vulture and the lammergeier. The lammergeier appears occasionally in the area and is one of the most important species of the island since the Cretan population is the only one breeding in the entire Balkans.

In respect to mammals, 14 species have been recorded in the park area, four of which are cetaceans, such as strictly protected bottlenose dolphin and the Mediterranean seal, the bottlenose dolphin and the common dolphin. Of the terrestrial mammals, the most characteristic are the hare, the weasel, the ferret, the badger, and the porcupine, while in the caves you can find the bats, which are a strictly protected species. Many of the eight species of reptiles and two of the three species of amphibians in the area are included in Directive 92/43 EOK and the International Bern Convention. All three-amphibian species of Crete are found in the area, the green toad, the tree frog, an endemic species in Crete and the only species of tree frog in Europe, and the common lake frog.

Among the most important reptiles of the area is the river turtle, the only species of water turtle in Crete that can be seen in streams in the palm forest of Vai, in the gorge at Toplou monastery and especially in Kato Zakros. Also, the sea turtle Caretta-Caretta breeds on the sandy beaches in the palm forests of Vai, Kouremenos and Xerokampos. Very important species for the area are the Podarcis cretensis lizards which are the only endemic lizard species of the island and the liakon, which its habitats are distributed in Italy, Greece, and North Africa. Of the snakes in the area, none are dangerous to humans, the tree snake and the house snake, the most beautiful snake in Greece, are completely harmless, while the garter snake is the only snake on the island with venom, but it is very weak one. In addition, the following areas of the Municipality of Sitia have joined the "NATURA 2000" Network (Community Directive 92/43/EOK) (Figure 43) and are of great interest for their environment:

- **Kapsa Monastery (Kapsa Gorge and wider area):**

The area is located in the South-Eastern part of Crete, about 35 km east of Ierapetra. It includes a small gorge 3 km long, which has the same name as the monastery located inside the gorge. At the exit of the gorge towards the sea, there is a small sandy beach with dunes. The area includes cliffs, gaps and rocks. There are also barns in good condition. The marine part covers less than 1% of the total area of the region. The types of habitats found in the area are: Steep rocky coasts with Mediterranean vegetation (with endemic *limonium spp*.), Mediterranean rivers with periodic flow, Phrygana Sacropoterium spinosum, Stones of the Balkan Peninsula, Limestone rocks of the Aegean, Caves that are not touristically exploited, Riparian forests - galleries of the warm Mediterranean (Nerio - Tamaricetea). In general, the area has great aesthetic value. It is also of great floral interest (it includes 14 endemic and locally endemic species as well as rare ones) due to its geomorphology.

- **Koufonisi Island:**

To the southeast of Xerokampos, at Koufonisi Island, the archaeological spade brought to light ruins from Minoan and Roman era facilities. It seems that the island was densely populated from the earliest

[31] Red Book of threatened Vertebrates of Greece

times until the late Roman period. This is proven by the large Greco-Roman theater with 1000 seats that was excavated. According to the findings, the island was a center for the collection and processing of the purple seashell that thrives in the seas of the area.

- **Kavo Sideros (Sidero Peninsula):**

The well-known cape in N-E tip of Crete, the ancient Samonion or Salmonion. A paved road 18 km from Palekastro leads to the Naval base at Kyriamandi Bay (passage permit required). It is a landscape of special character and natural beauty with the rocky surfaces, the many small and picturesque coves reminiscent of fjords and the open space. At the end of the cape, the ruins of a 14th century church of St. Isidoros were found, where the name of the cape originated, while next to it there is the newest church of the same name. According to Apollonius of Rhodes, the Argonauts landed at Cape Samonio returning from Colchis and there they built the temple of Minoan or Samonian Athena. On the beach of the small bay and for the most part in the sea, the ruins of a temple of the 4th BC were found. Near the church rises the imposing building of the Lighthouse, which still operates today and was built in 1880. The sea area is full of reefs, dry land, and ancient shipwrecks. In the area of Kavos, which is very interesting from an archaeological point of view, ancient inscriptions, rock paintings and quarries were found and they were constructed from the amazing grey-black stone from which many buildings of Itanos and other ancient cities were built.

- **Dionysades Islands:**

The Dionysades Islands are a cluster of islands in the north of the gulf of Sitia. They are 10 miles from the city of Sitia and consist of four uninhabited islands: Giannisada, Dragonara, Paximada and Paximadaki. The total area of the four islands is 5,252 km^2. The largest island of the complex is Dragonara with an area of 2.84 km^2, followed by Giannisada with an area of 2.08km^2, Paximada with an area of 0.30km^2 and finally the smallest island Paximadaki or Prasonisi with an area of only 0.032 km^2. The highest peak in Dionysades is in Giannisada with a height of 127 m. To the east of the island are the “Columns”, huge rocks that grow out of the sea and reach a height of up to 40 meters. On the island of Dragonada there is also the “cave of Dragonada”, which is about 20×30 m, and can only be visited by boat.

Dionysades are mainly composed of Permian limestones, which create vertical sea fronts, ideal habitats for hosting and nesting migratory and predatory birds as well as seabirds. The low-altitude islands are covered by phrygana and degraded makki with the presence of a significant number of endemic and narrow-endemic plants.

Characteristically important birds found in the area are the Artemis (*Calonectris diomedea*), the seagulls (*Larus audouinii*), the peregrine falcon (*Falco peregrinus*) and the black petrel (*Falco eleonorae*), with the latter living specifically on the Paximada and Paximadaki rocky islands. 15% of the world's falcon population have built their nests on these two islands, which are also the largest colony in the world. Today there are about 850 couples on the two rocky islands. In 1995 the E.O.E. (Hellenic Ornithological Society) and ETH.I.A.G.E., in a study they did in the framework of the ENVIREG program (Identification and Evaluation of Avian Habitats) for inclusion in the Community Network of Directive 79/409/EOK, 157 bird species were identified, 26 of which are endemic to the Aegean Sea.

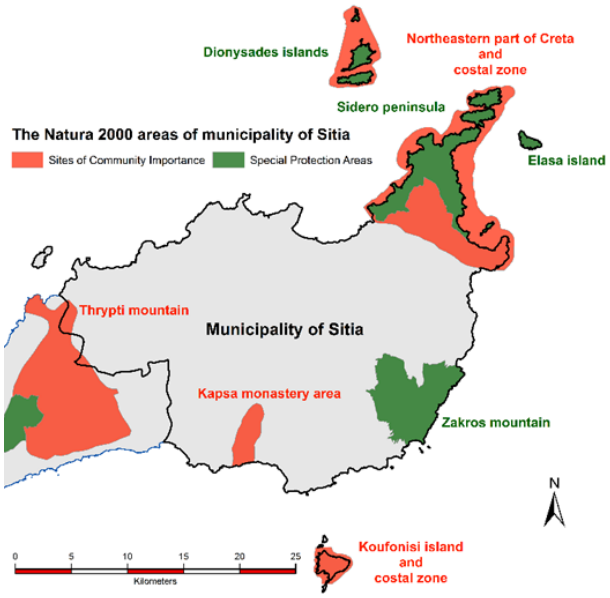


Figure 43. The Natura 2000 of Municipality of Sitia. Source: Geospatial Information Infrastructure of the Region of Crete[32]

In addition to their importance for birdlife, Dionysades are home to the endemic lizard subspecies *Podarcis erchardii rechingeri*. In the marine area, there are the Mediterranean seal (*Monachus monachus*), the bottlenose dolphin (*Tursiops truncatus*), sea turtles *Careta careta* as well as the rare for Crete marine plant Ruppia cirrhosa (*Ruppia cirrhosa*)[33].

Climate change is recognised as a serious threat to biodiversity and the ecosystems globally. The effects of climate change on this sector are multifaceted, since biodiversity can be affected by climate change in many ways: (a) having direct impacts on organisms, for example affecting survival rates or reproductive success among species, (b) having effects through changes in abiotic interactions (e.g., conferring competitive advantage) and (c) having effects through changes in abiotic factors (e.g., water submergence, changes in ocean currents). However, climate change is not the only pressure affecting biodiversity, and its effects depend also on interactions with other parameters, such as changes in land use which may lead to species losing their natural habitats and subsequently reducing their ability to migrate and reproduce.

The climate hazards identified that could potentially affect biodiversity in Sitia include:

- An increase in temperature.
- An increase in the maximum temperatures and the events of heatwaves.
- A decrease in precipitation.
- The lengthening of drought periods.
- The increase of the intensity of rainfall and the frequency of flooding events.
- Sea level rise affecting coastal ecosystems.

According to the studies on the vulnerability of biodiversity due to climate change[34], the growth rate of flora species could be affected, as well as the distribution of flora and this could lead to changes in the availability of food for animal species and even the elimination of plant species. A risk of increase

[32] https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map7_loader_public&lon=2907892.2020578&lat=4184952.231875&zoom=11

[33] http://www.ecovalue-crete.eu/el/sites/gr4320011)

[34] https://www.crete.gov.gr/wp-content/uploads/2023/03/%CE%9C%CE%B5%CE%BB%CE%AD%CF%84%CE%B7-%CE%A0%CE%95%CE%A3%CE%A0%CE%9A%CE%91-%CE%91%CF%8D%CE%B3%CE%BF%CF%85%CF%83%CF%84%CE%BF%CF%82-2022.pdf

in pests, pest infestations and alien species invasion is also high. High temperatures and prolonged droughts may lead to early initiation of processes typically expected in spring (e.g., leaf opening, migration, oviposition) and a lack of available water resources to cover needs of fauna. The increase of flooding events on the other hand may cause loss of animal population due to drowning, inhibition of seed germination and a decrease in the availability of nutrients in the soil. Finally, the increased erosion of coastal land ecosystems could affect vegetation due to the salinization of coastal soils.

○ Tourism, leisure and cultural heritage

The economy is strongly dependent on tourism. However, the archaeological sites and the natural environment have not been exploited for tourism to a significant extent. Sitia falls short in another point which is decisive for its tourism development, and this is none other than the number of beds it has to offer to tourists and travellers. Today the city of Sitia has only 1,000 beds, while the Municipality of Sitia has a total of about 6,500 in accommodation and hotels. A large number of them are in the area of Makris Gialos (about 2,500 of them), while others are in areas such as Mochlos, Palekastro, Zakros, Xerokampos. Figure 44, presents the evolution in the number of hotels in Sitia Municipality.

Figure 44. Evolution of the hotel facilities of the Municipality of Sitia. Source: Hellenic Chamber of Hotels[35]

Tourism is one of the most important sectors for the region's economy, due to its high participation in the region's GDP and employment. The climate of Sitia and the weather conditions could be considered as part of the touristic product since it is one of the main reasons why visitors choose the area for their travels and by extension this “product” is vulnerable to climate change. High temperatures, extreme weather and lack of water are just some of the effects that are expected to significantly affect the sector of tourism.

More specifically, climate hazards that may affect tourism are related mainly with:

- The increase in temperature (mainly the maximum temperatures), especially during the summer period.
- The increase in occurrence of strong winds, especially during the summer season.
- Heatwaves and the increase in the discomfort index.
- The increase in the frequency of heavy rains, especially during the summer period.
- Sea level rise in terms of coastal touristic infrastructure.

According to studies regarding the vulnerability of the sector to the effects of climate change[36], a reduction of the average length of stay of visitors during the summer season may occur or even a

[35] https://www.grhotels.gr/category/epicheirimatiki-enimerosi/statistika/dynamikotites
[36] https://www.crete.gov.gr/wp-content/uploads/2023/03/%CE%9C%CE%B5%CE%BB%CE%AD%CF%84%CE%B7-%CE%A0%CE%95%CE%A3%CE%A0%CE%9A%CE%91-%CE%91%CF%8D%CE%B3%CE%BF%CF%85%CF%83%CF%84%CE%BF%CF%82-2022.pdf

decrease in the number of visitors due to extreme events (flooding, heatwaves), the degradation of the natural ecosystems, the damage to coastal touristic infrastructures, as well as deformations, damage or even destruction of Archaeological Sites of the region. Also, an increase in energy consumption and therefore in energy costs of hotel units, leisure facilities, museums and other touristic infrastructures due to the increased for cooling during the summer months is expected.

However, there is a possibility that climate change may have some positive effects on the sector of tourism as well. More specifically, it may help extent the touristic season in periods of the year that do not present high visiting rates at the moment, such as winter. It may also help reduce energy consumption and therefore the energy costs of hotel units and other facilities related to tourism during the year, due to a reduced need for heating.

3.1.2. Climate change factors analysis: adaptation and mitigation baseline

To evaluate the mitigation baseline in Sitia Municipality, the Emissions Database for Global Atmospheric Research (EDGAR[37]) was used. EDGAR provides emissions (tCO_2) in a yearly basis from national to regional level, being useful to define the baseline of Sitia applying downscaling procedures based on the population level along the evaluated temporal dimension. Data, cover specific sector being grouped into seven categories: agriculture, power industry, buildings, waste, transport, other industrial combustion and others. The evolution of the emissions is presented in Figure 45.

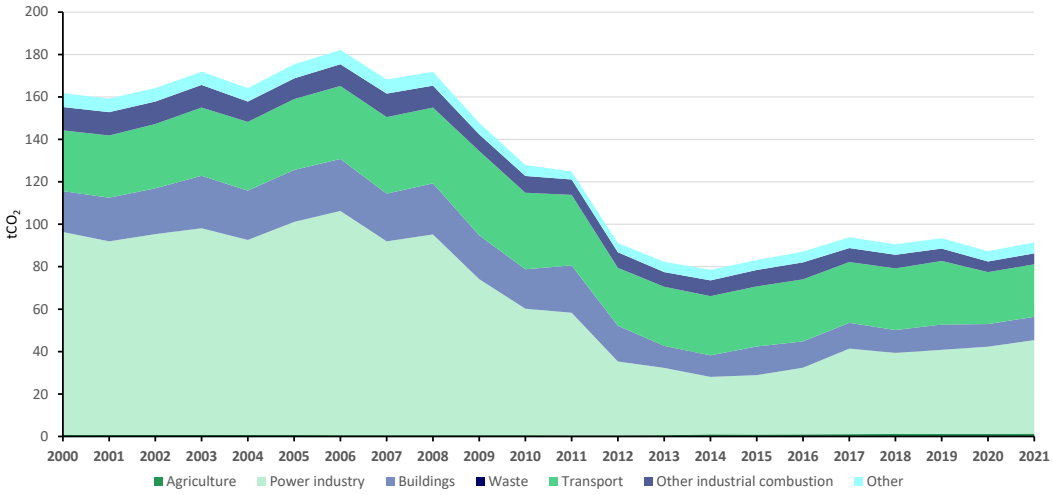


Figure 45. Evolution of CO_2 emission in Sita Municipality between 2000 and 2020. Source: Own calculation based on EDGAR data.

Considering the results presented in the previous figure, the power industry and transport are the main principal CO_2 emitters in the Municipality followed by buildings. Industrial combustion and others, are also relevant according to their emissions level being waste and agriculture emissions almost residual in the case study. Although the emissions have been reduced of a 50% since 2000, it is necessary to highlight the need to continue with the implementation of measures to reduce the emission levels from industry, transport and buildings.

To complement the emissions analysis, the carbon stock in vegetation and soil in provided (Figure 46) using geolocated data from ESA Biomass Climate Change Initiative[38] and Global Soil Organic Carbon Map (from FAO)[39], on soil organic carbon and biomass stock that was translated in carbon stock using default values provided by the IPCC. As a result, the carbon stock in soils is higher the 45,096 $MgCO_2$,

[37] https://edgar.jrc.ec.europa.eu/
[38] https://data.ceda.ac.uk/neodc/esacci/biomass/data/agb/maps/v4.0
[39] https://data.apps.fao.org/glosis/?share=f-6756da2a-5c1d-4ac9-9b94-297d1f105e83&lang=en

while the carbon stock in the biomass increases to 246,031 $MgCO_2$. The evolution of carbon stock in biomass along the year with available data is represented in Figure 47. It is observed how the carbon stock in the biomass has been reduced in a very visible way since 2010.

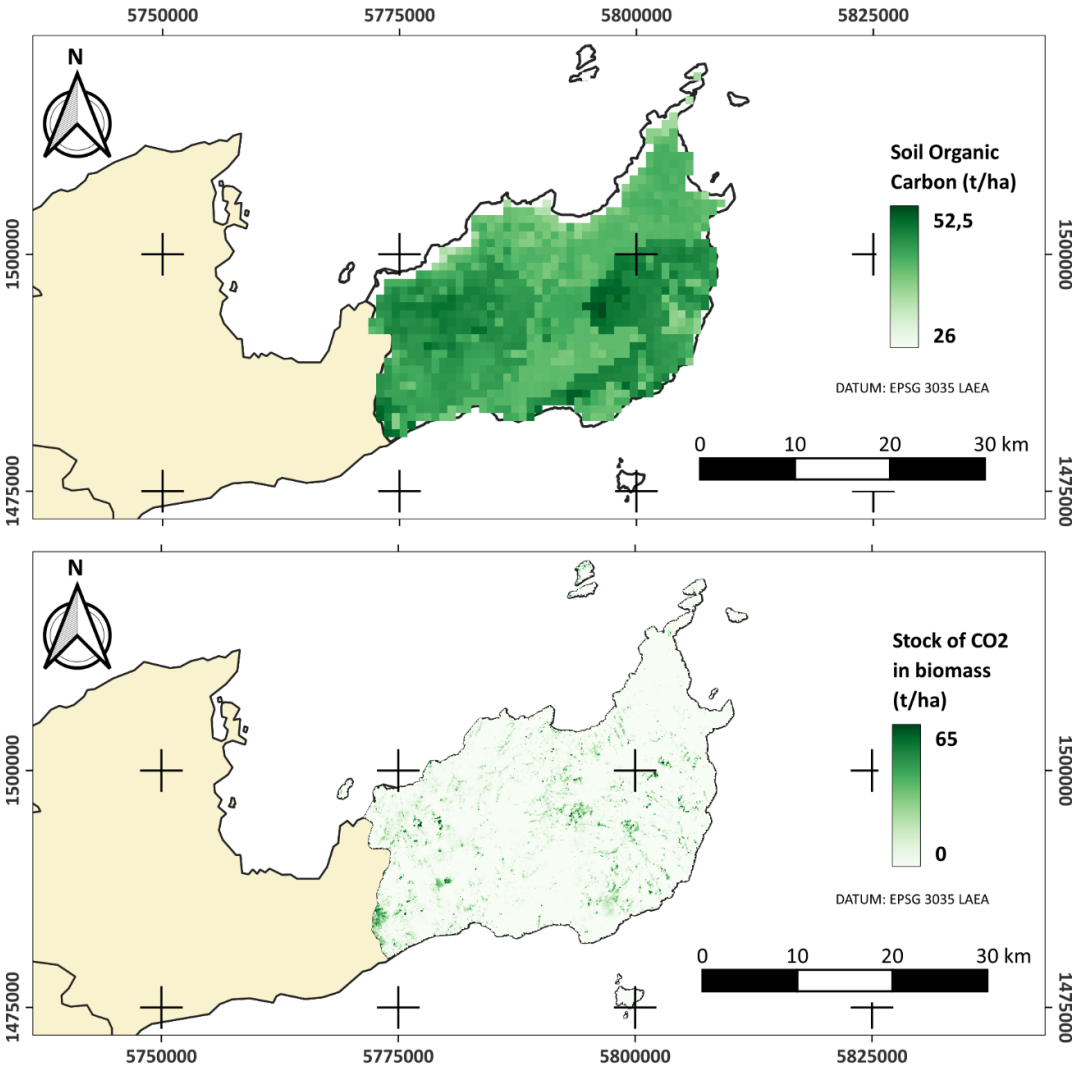


Figure 46. Carbon stock (tCO_2) in soils (top) and carbon stock (tCO_2) in biomass for Sita Municipality in the reference year. Source: Own calculation based on ESA Biomass Climate Change Initiative and Global Soil Organic Carbon Map (from FAO) data respectively.

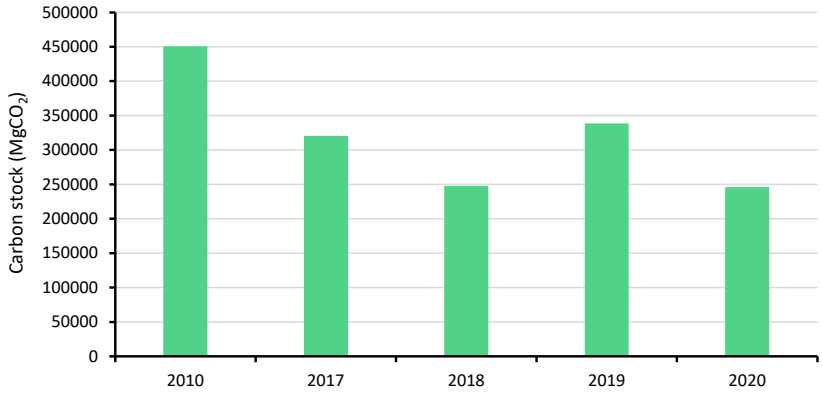


Figure 47. Carbon stock in biomass ($MgCO_2$) for Sita Municipality between 2010 and 2020. Source: Own calculation based on Global Soil Organic Carbon Map (from FAO) data.

3.1.3. Past experience and legal framework analysis

For the past experience and legal framework analysis of Sitia Case Study, four key documents were identified and further analysed, as all of them were considered of great relevance for the characterisation of the case study. The detailed information of this analysis can be consulted in Annex 1 in section 11.1. Table 18 includes the relation of those documents analysed deeply and a few key aspects on them. This legal framework will help to define the starting point for policy implementation considering the most important sectors and the associated climate change impacts.

Table 18. Relevant documents analysed for CS1 Crete Island – Sitia.

#	Name of the document	Type	Scope	Year	Main sectors
1	**National climate change adaptation strategy – Greece**	Strategy	National	2016	• Water and Waste • Tourism, cultural heritage • Biodiversity and natural heritage • Agriculture, forestry and fishing • Energy • Transport
2	**Crete Regional climate change adaptation plan**	Strategy	Regional	2021	• Water and Waste • Tourism, cultural heritage • Biodiversity and natural heritage • Agriculture, forestry and fishing • Energy • Transport
3	**National plan for increasing the number of nearly zero-energy buildings**	Plan	Sectoral	2017	• Cities and urban planning
4	**Civil Protection guidelines**	Guideline	Local	2020	• Society

3.2. PESTLE results for the local ecosystem drivers' analysis

This section discusses how the impact of climate change, and adaptation and mitigation policy implementation are affecting the Sitia region based on political, economic, social, technological, environmental and legal factors. Table 19 below provides details of the key items collected for each PESTLE factor. The sources for the information provided in the table are from the data collection results which came from the different exercises with stakeholders, the case study leader and supporter to identify the main drivers and the data sources to understand the local ecosystem (reported in section 11.2 Annex 2. Case Study 1 – Island (Sitia): PESTLE results for the local ecosystem drivers' analysis). The process to complete this PESTLE was explained in the methodological part of this document (section 2.2).

Table 19. Results from Sitia PESTLE analysis.

Factors	Category	Details	Impact status
Political	Governmental policy	City planning ▪ Land use plan. ▪ Civil Protection plan	Positive
	Environmental policy	Natural heritage protection plan ▪ Protective regime	Positive
	Initiatives	Promotion of POD products	Neutral
	Issues	No collaboration between citizens and authorities ▪ No prevention willingness	Negative
Economical	Economic growth	Green employment promotion ▪ Boost of the economy based on tourism sector in case of natural disorder	Positive
	Economic taxes	High taxes ▪ High energy prices	Negative
	Energy	Renewable energy investing ▪ Energy upgrade	Positive

Factors	Category	Details	Impact status
	Financing capabilities	LIFE+ and Interreg programs ▪ Integrated Territorial Investment Instrument	Positive
	Promotion.	Promotion of local product ▪ Promotion of local product production ▪ Promotion of organic farming	Neutral
	Support	Transportation for the collection of honey	Neutral
Social	Population growth	Depopulation ▪ Digital illiteracy	Negative
	Health	Climate change awareness	Positive
	Local Activism	Farmers union and cooperative ▪ Active volunteering groups with environmental awareness ▪ Local NGO that promotes awareness ▪ Local organizations to support vulnerable groups ▪ Local initiatives to decarbonisation	Positive
Technological	Improvements	Capacity to install more renewable power (PV and wind farms) ▪ Improvement of the agricultural machinery ▪ Wastewater treatment and reuse of water rain	Positive
	Issues	Limited access to digital and internet services ▪ Lack of monitoring technologies ▪ No alternative to cars	Negative
	Solutions	Dam for irrigation ▪ Become carbon free. ▪ ICT solutions ▪ Implementation of Smart Cities system ▪ Focus R&D for climate change adaptation/mitigation.	Positive
Environmental	Sustainability	Fauna and flora in danger ▪ Proactivity in environment protection ▪ Study and development of resilience ▪ Preservation of natural resources ▪ Expansion of the Geopark	Positive
	Carbon footprint	Reduction of energy consumption ▪ More PV and wind farms installation ▪ Change in the pattern of energy consumption	Neutral
Legal	Legislation	Hunting and fishing periods ▪ Requirement of Environment Impact Assessment ▪ Law to support sustainable investment	Positive
	Equal opportunities	Gender equality plan or study	Positive
	Necessary legislation	Regulation of Alien species ▪ Protected marine areas	Positive
	Environmental	UNESCO Geopark guidelines ▪ Regulation of Protective Origin Products ▪ Legal framework for protected areas or areas with special interest	Positive
	Fines	Fines for non-compliance about burning waste ▪ Fines to illegal and dangerous structures	Negative

If we consider the **political factors**, we can see the relevance of plans and strategies as factors that help to manage urban and land use change through the adoption of measures to protect the environment and take care of the citizens in the face of climate change and extreme climate events. However, the support from citizens and institutions is low, which hinders the implementation processes of the different measures, as well as the consideration of different aspects through public participation. The financial and economic crisis and the subsequent austerity measures may have impacted citizens' perception on the quality of government. In this sense, a quality index less than 20 for 2017 in Crete island was reported[40].

If we analyze the **economic factors**, investment in tourism, the promotion of local products and business models for economic activities, can serve to guide the population's capacity to become climate aware and advance in the decarbonization of the region's economy through the improvement in the use of renewable energy. There are programmes like LIFE+ and Interreg, which allows Sitia municipality to develop sustainable solutions to the development challenges and take part in the environment and climate action. The economy, has traditionally been based on agriculture. Thanks to

[40] ESPON territorial patterns

Government subsidies, the economy is growing as it is reflected in the GDP. The GDP of the regional Department of Lasithi, in which the Municipality of Sitia belongs to, in 2020 was 1.074 million € (normalised to the 2015 prices) corresponding to 14,591€ per capita[41] in 2020 and being lower than 10 years before (15,522). The efforts of local authorities on the promotion of development especially in the fields of agriculture, industry, commerce, construction and tourism is generating a good evolution of the GDP. It is necessary to highlight that at national level, Greece has experienced the second highest increase in regional economic disparities among Organisation for Economic Co-operation and Development (OECD) countries between 2000 and 2018.

Social factors in the municipality of Sitia are influenced by the population, its evolution and the equality aspects. The Municipality of Sitia reached 20,438 inhabitants in 2021[42], the majority of whom live in the capital (almost 78%) with the approximate population density of 57 inhabitants/km^2. Population in 2021 (20,438) has increased by 3.2% compared to 2011 (19,720), being 26% of the total population of the Lasithi region. Regarding their gender distribution, 50.3% are men while 49.7% are women, this gender distribution being constant over the last years. Migration rate in the region is less than the 4% using reference values of 2014 provided by ESPON territorial patterns. The promotion of actions in the region is guided by NGOs and local organizations and initiatives that enable training campaigns and activism to improve the population's awareness of the reality of climate change. The Gini coefficient ranges between 0.25 and 0.35 in 2019[43] depending on the municipality, reflecting that incomes are not very different among areas. This coefficient fluctuates significantly between 2017 and 2019 with a no clear trend between years.

Technological factors consider the role of technology as a driver to guide adaptation and mitigation against climate change. With great interest in the development of PV and wind farms, management of water and Smart Cities System implementation. In the municipality, agriculture and local production (main economy sector) received most of the incentives for the technological development ensuring and improvement of the efficiency. Local governments are promoting Innovation Zones with incentives to develop the research and productive activities. Attractive location opportunities for foreign research ICT companies are offered.

Regarding **environmental factors**, inside UNESCO Global Geopark of Sitia various activities and infrastructures have been developed to support geotourism and ecotourism. Initiatives at different scales to protect environment stand out, as well as to improve the energy efficiency. There are several studies that seek to improve resilience and sustainability awareness. Being a region dependent of agriculture and tourism, the commitment to sustainability is essential as a mean to ensure the survival of the ecosystem services of its territory and to avoid the loss and degradation of protected areas and ecosystems that produce the local products.

Finally, **legal factors** must be analyzed, directly related to the legislative framework and regulations to improve the adaptation and mitigation. We must highlight the initiatives to protect the environment and management of waste, or the fight against gender inequalities. Above all, we must highlight the relevance of adaptation and mitigation strategies, that are key to ensure the region's climate neutrality and its resilience. We also need to reflect the law for investment incentives to attract industrial companies. This law focuses on supporting sustainable investment projects with efficient tax breaks, favorable loans and state aids in selected business activities.

[41] https://www.statistics.gr/el/statistics/-/publication/SEL15/2021
[42] https://www.statistics.gr/el/2021-census-res-pop-results
[43] Regional observatory for social inclusion. Region of Crete.

3.3. Summary of case study characterization in Sitia

The region of Sitia, presents one of the most extreme climate hotspots in Europe due to thermal drought conditions, with sustained high winds, almost 300 sunshine days/ year and few rain events. According to the climate and weather analysis under historical conditions and the projection to a future period, the mean annual daily temperature will increase in more than 5.5 ºC in the most unfavourable scenario, meaning that the temperature will increase higher than 24.4 ºC by 2100. With respect to the evolution of the precipitation, the climate model shows a slightly increasing trend (around up to 4.90% in the most unfavourable scenario). In addition, the maximum annual daily cumulated precipitation increases in all evaluated periods except in the long term in the most unfavourable scenario, where there is more uncertainty (representative of more torrential events).

This climate tendency affects also the key vulnerable sectors in Sitia, identified by case study leaders and supporters, as well as considering also the view of the local stakeholders. These are the agriculture, water and biodiversity and natural heritage, as well as the tourism sector as related to all previous sectors and as a coastal area, and especially vulnerable for the climate change.

All land areas of Sitia region are cultivated and the rest of the land hosts and feeds goats and sheep in free pasture herds. This makes agriculture a key economic sector, and the majority of the population are farmers: olive growers, vine growers, vegetable growers, livestock breeders or beekeepers, while in the coastal villages there are fishermen as well. The tree crops correspond to around 53% of agricultural land, and mainly vines and olives are the most likely affected by the effects of climate change, which will impact the economy of the region. The main climate hazards that will affect this sector in Sitia are the increase of temperature, the lengthening of dry periods (droughts), the decrease in precipitation, and the increase in the intensity and frequency of flooding and radiation, as well as the sea level rise in coastal agricultural lands.

A big challenge for the region is to maintain sufficient and sustainable freshwater resources, of high environmental quality. As the water scarcity is a vulnerable sector for Sitia, due to droughts, and affecting at the same time both agriculture and people (including tourism). The existing water supply networks have numerous problems, the most severe related to improper maintenance due to very high costs. There is also a karst system (Sitia-Palaikastro hydrogeological system) that covers the water and irrigation needs of the region, with significant potential beyond tourism development, being a very important aquifer for this reason.

As the Sitia's Geopark is one of the most important environmental areas of the Mediterranean, the biodiversity is a key vulnerable sector for Sitia as well. It prevails the thickets of phrygana and aromatic plants. Geopark's area is of considerable floral interest, with hundreds of plant species, including unique species that only appear in the southeaster Aegean. With respect to the fauna, it hosts also a large number of the characteristic animals of the island and especially migratory birds.

The economy is strongly dependent on tourism, although archaeological sites and natural environment have not been exploited for tourism to a significant extent. This is mainly due to the number of beds that the city has with respect to the whole municipality. The climate and weather conditions of Sitia could be considered part of the touristic product, as it is one of the main reason's visitors choose the area, so the high temperatures, extreme weather and lack of water will inevitable affect the tourism sector.

The adaptation and mitigation baseline have been analysed as well, and can be outline that both power industry and transport are the main CO_2 emitters in the Municipality, followed by buildings. Although the emissions have been reduced of 50% since 2000, the reduction of emission levels, especially from those three sectors, is still needed. It is also worth highlighting the capacity for carbon stock in vegetation and soil, while the capacity for carbon stock in biomass has decreased in the recent years.

The analysis of past experiences in Sitia focused on four key documents, including the National Climate Change Adaptation Strategy, the Crete Regional Climate Change Adaptation Plan, as well as the National Plan for increasing the number of nearly-zero energy buildings and the Civil protection guidelines.

In accordance with the Local Council of Stakeholders of Sitia, the drivers of the case study as enabling factors for climate change policies implementation were analysed considering the aspects of a PESTLE analysis. Among them, the following can be outlined: natural heritage areas protection, promotion of local production, existence of Geopark of Sitia, and local bodies active in environmental protection.

4. Case Study 2 – Mountain region (Trentino) characterisation

The Autonomous Province of Trento is located in the north-east of Italy in the geographical area commonly known as Trentino (Figure 48). It features an almost entirely mountain territory and is characterised by a richness of unique environments.

Trentino is characterised by a variety of morphologies, with different climatic and environmental conditions: from alpine climate in mountain valleys to sub-Mediterranean climate close to the Lake Garda. Valleys oriented in different directions and of different widths, mountain ranges, lakes, basins and hills, which therefore create a remarkable climatic variety (Trentino Clima, 2023).

The administrative territory of the Province is divided in 166 Municipalities with 2 major cities - Trento and Rovereto - and 16 territorial bodies that group together several municipalities and are, in general, also identifying a homogeneous geographical and cultural area, called Comunità di Valle (Valley Communities). Trentino, with its 6,207.12 km^2 of territory, hosts 540,958 inhabitants with a population density of 87.15 inh/km^2 (according to the 1st January 2022 of the Provincial Statistical System - ISPAT).

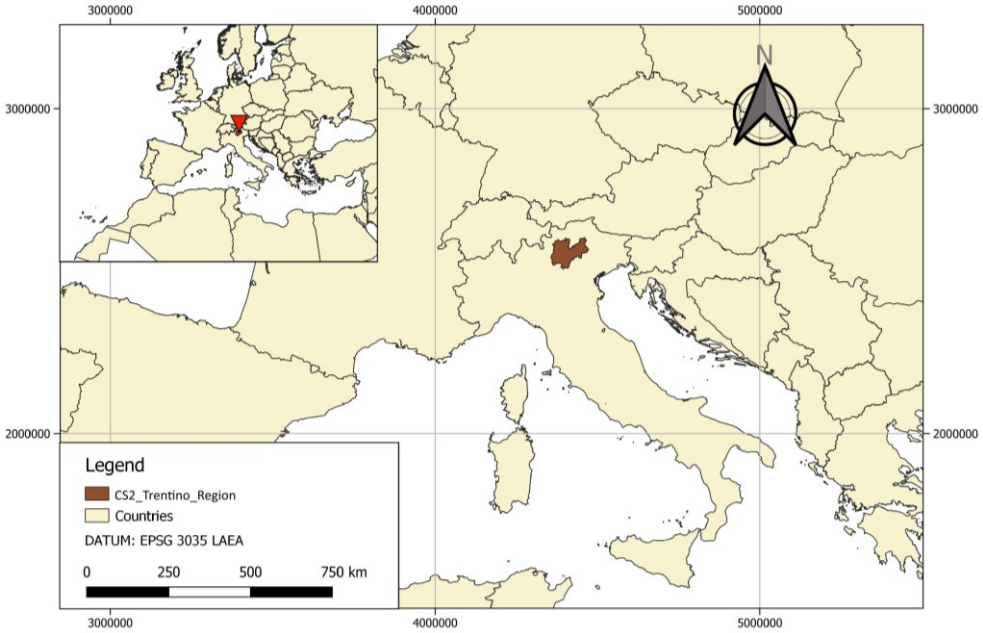


Figure 48. Location of CS2, Trentino - administratively the Autonomous Province of Trento

The population of the Province is unevenly distributed. A large proportion of residents in Trentino (215,064 individuals, or 40% of the total population) live in the five municipalities with more than 10,000 inhabitants. Less than a tenth of the population of Trentino (about 41,000 individuals), on the other hand, live in the 69 municipalities (about one third of all municipalities in Trentino) with less than 1,000 inhabitants. More than half of the residents in Trentino live in the valley bottoms at an altitude between 65-250 metres, while only 6% of the population live above 1,000 metres. In fact, depopulation of the mountains persists also in these territories. (APPA,2020a, with population data from 2018).

The Gross Domestic Product (GDP) of the Province in 2021 was 21,680 million € (20,523 million € normalised to the 2015 prices) while the GDP per capita was 40.03 thousand € (37.90 thousand € normalised to the 2015 prices) in the same reference year (according to the data of the Provincial Statistical System - ISPAT). In fact, Trentino GDP per capita is higher than most regions in Italy (GDP per capita for Italy 30.19 thousand € in 2021). Tourism and its linked sectors are the mainstay of the local economy, mainly in winter and summer and in fact it is interdependent with other key economic sectors in the region: agriculture, ecosystem services, trade, and energy.

4.1. Analysis of geographical landscape and historical climate conditions

This section includes an analysis of the historical and future climate in Trentino and also the main sectors that will be affected by forecast changes in the climate due to the increase of emissions and the associated effects in social, economic and environmental systems.

4.1.1. Climate analysis and characterisation of vulnerable sectors

In this section, two relevant objectives are covered: (i) an assessment of the main climate data (temperature, precipitation and wind) in the historical (1985-2015) and future period (from 2023 to 2100) under two different climate scenarios for Trentino and (ii) identification and description of the main assets per vulnerable sector that will be affected by future changes in the climate.

4.1.1.1. Climate and weather analysis

Climate analysis is based on the Essential Climate Variable (ECVs). More in detail, the following variables are evaluated: maximum annual daily cumulated precipitation, mean annual daily cumulated precipitation, mean annual daily maximum temperature, mean annual daily minimum temperature, mean annual daily mean temperature and mean annual daily mean surface wind speed.

- **Temperature**

If we analyse the obtained results of climate models in the future for temperature, we identified that the mean annual daily temperature in Trentino (5.00ºC in the historical period) will increase according to the two considered climate scenarios. It is expected that the mean annual daily temperature increases by more than 5ºC in the most unfavorable scenario (SSP585) in the long term. In this sense, the temperature will increase more than 10ºC by 2100. Considering the minimum and maximum mean annual daily temperature, the same pattern is expected facing a warmer climate with very high temperature in extremes. Table 20 presents the temperature results in Trentino for two different scenarios (SSP245 and SSP585) and the comparison with the mean values in the historical.

Table 20. Mean, Maximum and Minimum temperature and related anomalies comparing with the historical. Lighter red colour implies smaller changes while dark red implies higher changes.

Scenario and period		Mean temperature	Mean maximum temperature	Mean minimum temperature
Historical scenario		5,.00	9.25	0.71
SSP245 scenario	**2023-2039**	6.33	10.68	1.98
	2040-2069	7.06	11.45	2.66
	2070-2100	7.99	12.45	3.57
SSP585 scenario	**2023-2039**	6.52	10.83	2.04
	2040-2069	7.80	12.18	3.32
	2070-2100	10.47	15.02	5.90
Anomaly SSP245 scenario	**2023-2039**	1.32 ↑	1.43 ↑	1.27 ↑
	2040-2069	2.06 ↑	2.20 ↑	1.95 ↑
	2070-2100	2.98 ↑	3.21 ↑	2.86 ↑
Anomaly SSP585 scenario	**2023-2039**	1.51 ↑	1.58 ↑	1.33 ↑
	2040-2069	2.79 ↑	2.93 ↑	2.61 ↑
	2070-2100	5.46 ↑	5.77 ↑	5.19 ↑

Figure 49 presents the results of the evolution of mean annual daily temperature along the period 2015-2100 using downscaled data from eight different climate models for the SSP245 climate scenario. The average value for the eight models under SSP245 is presented in Figure 50 where the confidence interval is represented by the maximum and minimum value of the set of models in each simulation year. The same representation for the temperature variation under SSP585 climate scenario is included in Figure 51 and Figure 52 respectively. Results show a high heterogeneity between model results and scenario with a growing trend along the evaluated period in both cases, being higher the temperature increase in the most extreme scenario (SSP585).

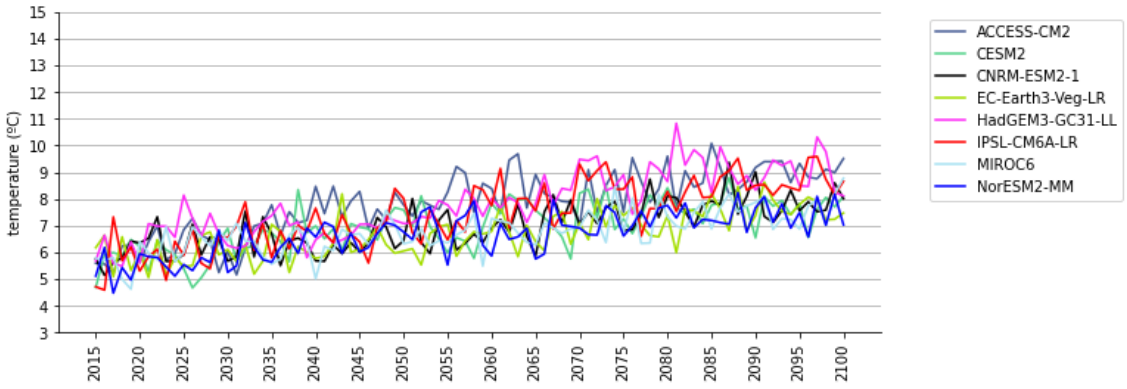


Figure 49. Mean annual daily temperature in the SSP245 scenario (2015-2100) for eight models in Trentino obtained by statistical downscaling procedure.

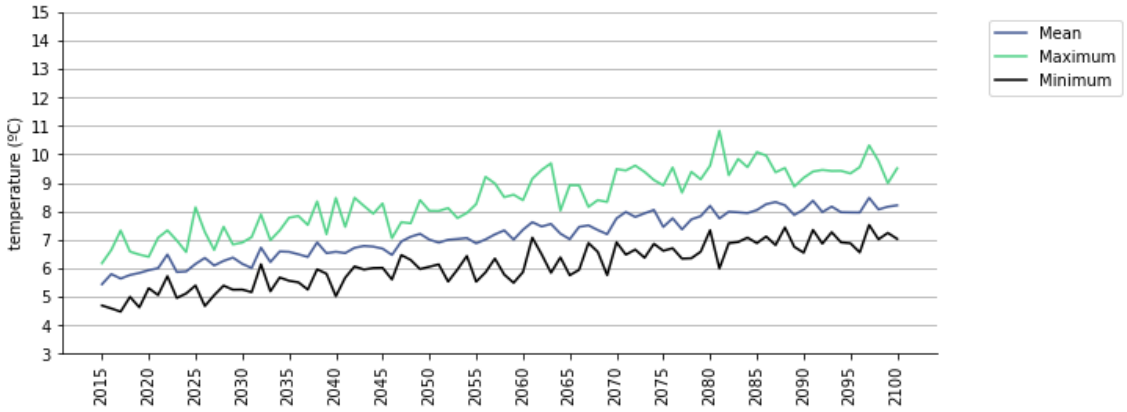


Figure 50. Ensemble mean annual daily temperate and range of variation (Maximum and Minimum) for a set of eight models in the SSP245 scenario (2015-2100) for Trentino.

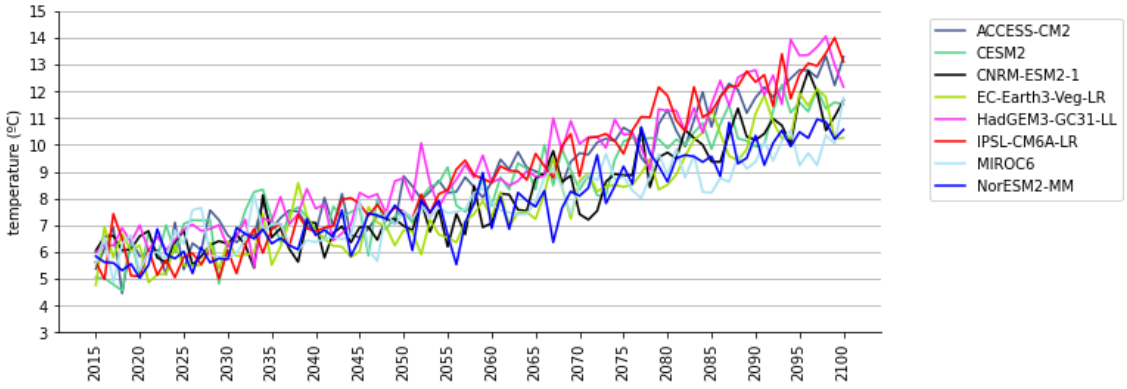


Figure 51. Mean annual daily temperature in the SSP585 scenario (2015-2100) for eight models in Trentino obtained by statistical downscaling procedure.

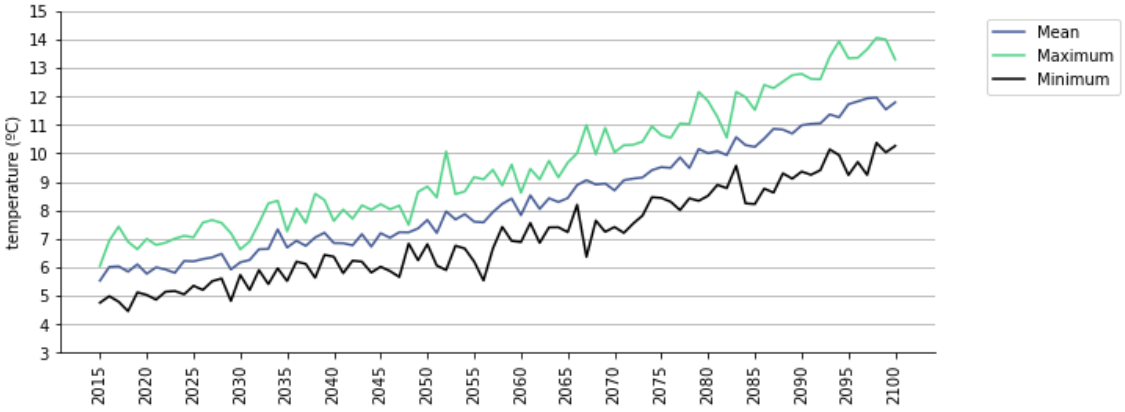


Figure 52. Ensemble mean daily annual temperate and range of variation (Maximum and Minimum) for a set of eight models in the SSP585 scenario (2015-2100) for Trentino.

○ Precipitation

The evolution of precipitation in the future shows a slightly increasing trend, which is the same to that observed for temperatures. Considering this evolution throughout the time periods analyzed (Table 21), the increase in precipitation will be more visible in the most unfavorable scenario (SSP585). The mean annual daily cumulated precipitation observed in the historical period is 4.28 mm/day, which is equivalent to an annual precipitation of 1562.2 mm. The results of the models for the future, forecast a raise in precipitation of up to 4.90% in the most unfavorable scenario. This increase will mean an average of 76.65 mm of precipitation per year. On the other hand, the maximum annual daily cumulated precipitation increases in all evaluated periods except in the long term in the most unfavorable scenario where there is more uncertainty. This is representative of more torrential events.

Table 21. Mean and Maximum annual daily cumulated precipitation and related anomalies comparing with the historical. Lighter blue colour implies smaller changes while dark blue implies higher changes.

Scenario and period		Mean annual daily cumulated	Maximum annual daily cumulated
Historical scenario		4.28	66,27
SSP245 scenario	**2023-2039**	4.41	69,42
	2040-2069	4.50	71,80
	2070-2100	4.49	73,80
SSP585 scenario	**2023-2039**	4.47	71,11
	2040-2069	4.35	73,41
	2070-2100	4.29	75,54
Anomaly SSP245 scenario	**2023-2039**	0.14 ↑	3.15 ↑
	2040-2069	0.23 ↑	5.53 ↑
	2070-2100	0.21 ↑	7.53 ↑
Anomaly SSP585 scenario	**2023-2039**	0.19 ↑	4.84 ↑
	2040-2069	0.08 ↑	7.14 ↑
	2070-2100	-0.03 ↓	9.27 ↑

Figure 53 presents the results of the evolution of the mean annual daily cumulated precipitation along the period 2015-2100 using downscaled data from eight different climate models for the SSP245 climate scenario. The average value for the eight models under SSP245 is presented in Figure 54 where the confidence interval is represented by the maximum and minimum value of the set of models in

each simulation year. The same representation for the mean annual daily cumulated precipitation variation under SSP585 climate scenario is included in Figure 55 and Figure 56 respectively. The results by model have a great heterogeneity, which is very visible in the figures for comparing the results of the models, where no clear trend is observed by model evaluating the precipitation results.

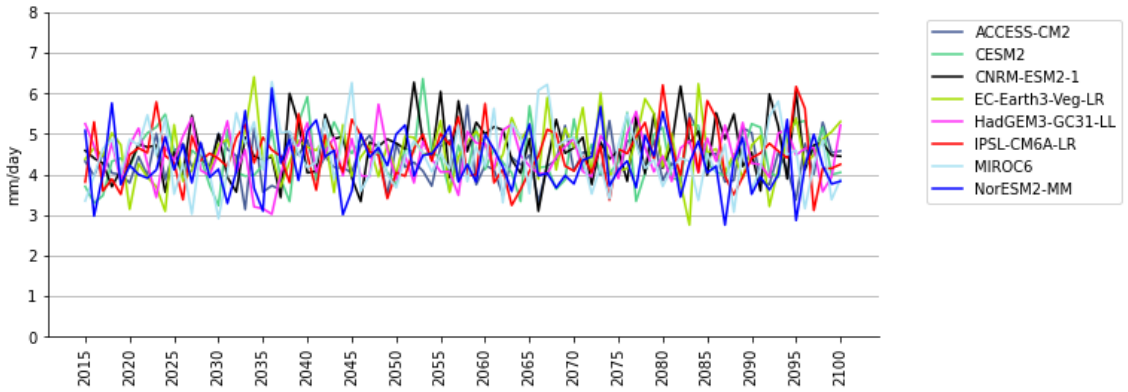


Figure 53. Mean annual daily cumulated precipitation in the SSP245 scenario (2015-2100) for eight models in Trentino obtained by statistical downscaling procedure.

Figure 54. Ensemble mean annual daily cumulated precipitation and range of variation (Maximum and Minimum) for a set of eight models in the SSP245 scenario (2015-2100) for Trentino.

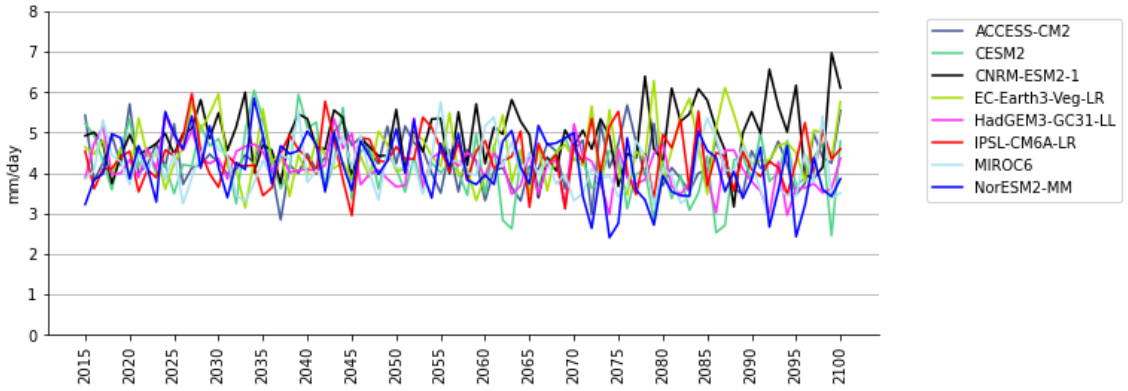


Figure 55. Mean annual daily cumulated precipitation in the SSP585 scenario (2015-2100) for eight models in Trentino obtained by statistical downscaling procedure.

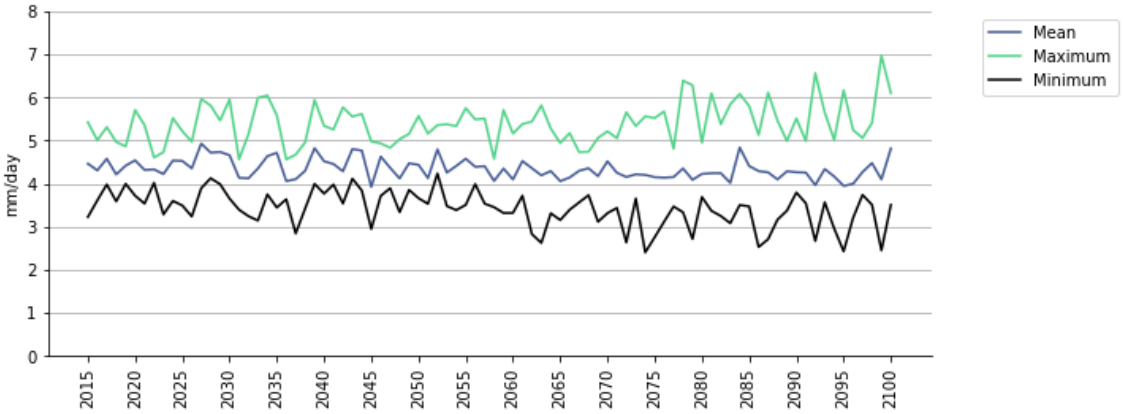


Figure 56. Ensemble mean annual daily cumulated precipitation and range of variation (Maximum and Minimum) for a set of eight models in the SSP585 scenario (2015-2100) for Trentino.

○ Wind.

Analyzing the results of the two selected climate scenarios for the future to analyze the evolution of the mean annual daily wind speed in Trentino, a trend projects a very small decrease in the average wind speed if we compare it with respect to the average value of the historical scenario (Table 22). However, and despite the forecast decrease, the average value will not fall below 2.22 m/s even in the most unfavorable scenario (SSP585).

Table 22. Mean annual daily surface wind speed and related anomalies comparing with the historical.

Scenario and period		Mean annual daily surface wind speed
Historical scenario		2.25
SSP245 scenario	**2023-2039**	2.25
	2040-2069	2.22
	2070-2100	2.20
SSP585 scenario	**2023-2039**	2.24
	2040-2069	2.23
	2070-2100	2.22
Anomaly SSP245 scenario	**2023-2039**	-0.00 ↓
	2040-2069	-0.03 ↓
	2070-2100	-0.05 ↓
Anomaly SSP585 scenario	**2023-2039**	-0.01 ↓
	2040-2069	-0.02 ↓
	2070-2100	-0.03 ↓

Figure 57 presents the results of the evolution of the mean daily wind speed along the period 2015-2100 using downscaled data from six different climate models for the SSP245 climate scenario. The average value for the six models under SSP245 is presented in Figure 58 where the confidence interval is represented by the maximum and minimum value of the set of models in each simulation year. The same representation for the mean annual daily wind speed variation under SSP585 climate scenario is included in Figure 59 and Figure 60 respectively. The results show that NorESM2-MM model obtained higher wind results if we compare with the rest in which the result heterogeneity represent a not clear trend being the wind velocity more or less constant in the evaluated period.

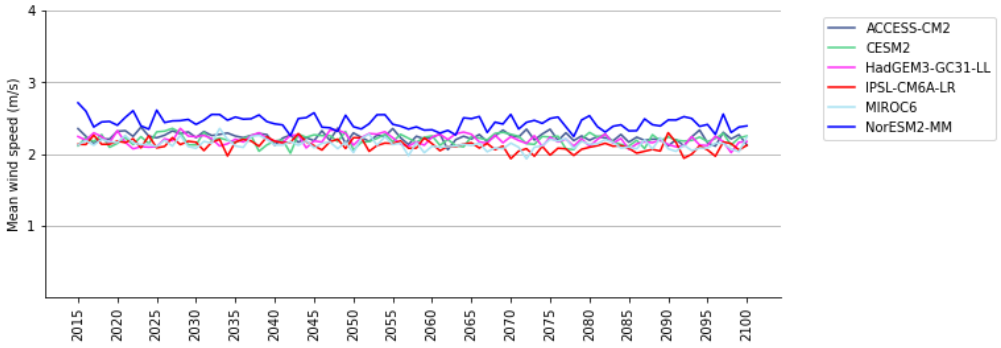


Figure 57. Mean annual daily wind speed in the SSP245 scenario (2015-2100) for six models in Trentino obtained by statistical downscaling procedure.

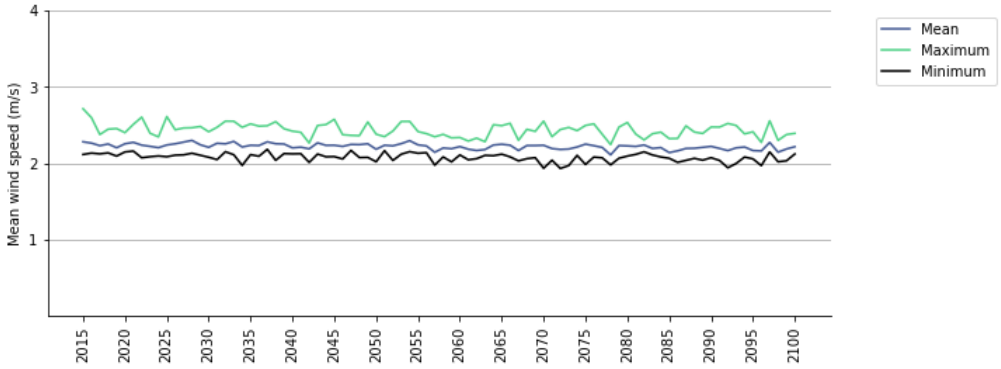


Figure 58. Ensemble mean annual daily wind speed and range of variation (Maximum and Minimum) for a set of six models in the SSP245 scenario (2015-2100) for Trentino.

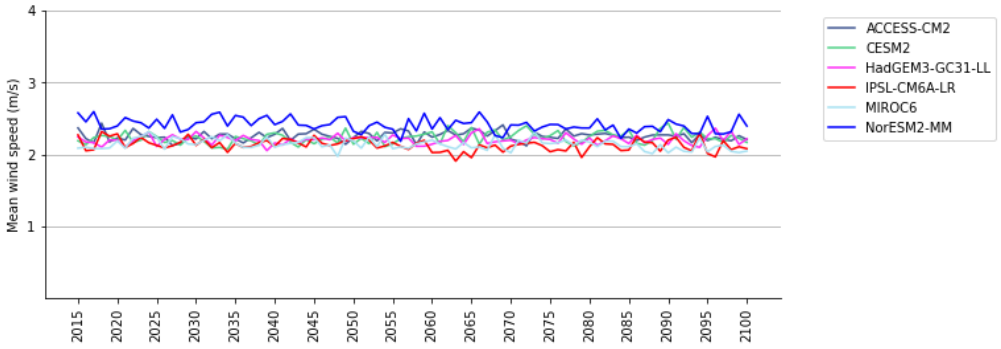


Figure 59. Mean annual daily wind speed in the SSP585 scenario (2015-2100) for six models in Trentino obtained by statistical downscaling procedure.

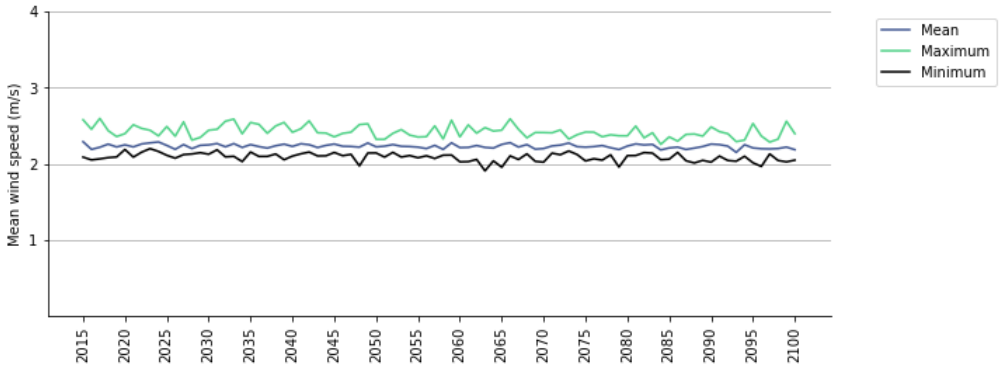


Figure 60. Ensemble mean annual daily wind speed and range of variation (Maximum and Minimum) for a set of six models in the SSP585 scenario (2015-2100) for Trentino.

4.1.1.2. Vulnerable sectors: identification of exposure assets

As introduced in section 2.1.1.2, the key vulnerable NEVERMORE sectors for Trentino case study are energy and tourism, leisure and cultural heritage for a high-level priority, and with a lower level priority, the water and waste, biodiversity and natural heritage sectors.

This was agreed with case study leaders in the first consultation (internal) as contrast exercise with the challenges and vulnerable sectors identified at the proposal stage. The activity consisted on an online Jamboard in which the CS leaders identified their main challenges, to then relate them with the sectors and priorities for each of them (Figure 61).

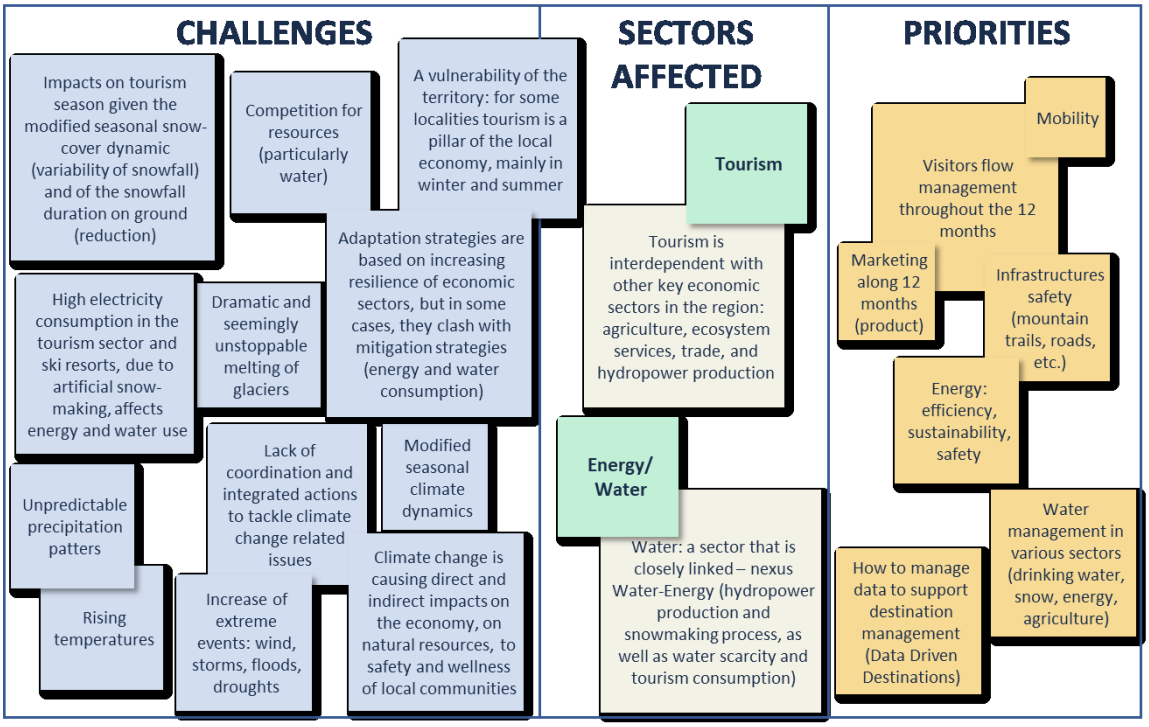


Figure 61. Results of the consultation with case study leaders on the challenges, related sectors affected and priorities

Then, the first consultation with the Local Council stakeholders was held, and a similar activity to confirm the selection and heard other voices on this was performed. During this activity (held the 2nd March 2023 in a face-to-face workshop) the main identified challenges raised by climate change can be clustered in the following according to the stakeholders' discussion:

I. The **cultural and awareness** challenge: there is a need for a collective cultural change that can trigger personal and general awareness of climate change issues emerged strongly. It is also related with the challenge of reclaiming the relationship between **human and nature**. It was also raised the challenge of **change of habits**, by, for example, trying to abandon the capitalism approach sought by visitors or the possibility of measuring the impact of certain choices/measures on CO_2 reduction or even the impacts of climate change.

II. **Changing tourism approach**: challenge of overcoming sectoral logic between tourism and other sectors, moving towards the redefinition or transformation of socio-economic models. The adaptive/transformative logic of tourism is placed as a key need: among the different tables, some concepts return, such as the need for the **evolution of the 'industrial' tourism model**, the overcoming of seasonality and the diversification of the winter tourism model. The aim is to be able to maintain the economy of the Valleys and continue to ensure that tourism can represent a sector that can promote them.

III. **Resource management**: the challenge of resources emerged clearly in the different working groups, highlighting for the case study mostly the sectors of **water** and **energy**. It will be necessary to better manage water resources for which competition is increasing and the need to conciliate concurrent uses. The challenge of increasing energy efficiency comes to the proposal to reinterpret building management and efficiency models.

IV. **Moving towards an integrated and dynamic approach to policies and strategies:** the prevailing challenges is the need to **identify policies** that are **integrated** across all sectors and that can **combine mitigation and adaptation**. The keyword "long term" was emphasized with a quote: 'think long-term but act short-term' through changing the perspective of policies and together with the **change of socio-economic patterns of the territory**.

Thus, prior selection of key vulnerable sectors for the Trentino case study were ratified through the stakeholder consultation and identification of challenges that can be related to the sectors identified.

○ Energy

The energy sector is very important in the Trentino economy due to an important share of produced renewables. Therefore, this sector is also key to understanding the implications that climate change impacts could generate particularly on linked sectors such as tourism. Trentino mitigation strategies are based on several actions in the energy sector, e.g., energy efficiency, renewable energy production and the electrification of final uses of energy in multiple sectors leveraging particularly on the surplus of local hydropower production (PEAP, 2021).

As recalled in the proposal of NEVERMORE the situation of energy generation within the Province is varied, in terms of type of source and in the type of user. The principal source of production is hydroelectric which sees large concessions mainly in the hands of energy producers and sellers. In fact, a characteristic element of the Trentino energy system is the abundant electricity production (5,489 GWh/year of which 4,321 GWh/year by hydro) that exceeds electricity consumption (3,322 GWh/year) by 65%. The Provincial Energy and Environmental Plan 2021-2030 reports that about 83% of electricity production of Trentino comes from renewable sources, with hydroelectric (15 year normalised) at 4,321 GWh/year followed by photovoltaic at 176 GWh/year, cogeneration (Combined Heat and Power) with solid biomass for district heating (District Heating) at 22 GWh/year and cogeneration with biogas at 19 GWh/year. This is therefore an annual production that on average exceeds local electricity consumption, providing a surplus of renewable electricity production (2016 data; PEAP, 2021). According to most recent data (ISPAT, 2021), Trentino produced 4901 GWh of electricity (gross production of 5,066 GWh). Particularly 80% of the electricity produced comes from renewable sources, and almost exclusively from hydropower (76% in 2021) (Figure 62). The remaining 20% comes from cogeneration plants using fossil fuels and biomass, while photovoltaic in 2021 represented the 4% share of the energy produced.

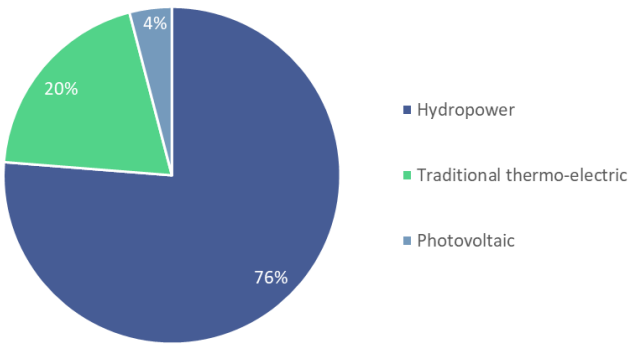


Figure 62. Electricity production by energy source used: traditional thermoelectric (biomass + fossil), photovoltaic, hydropower; net production (data from ISPAT - originally collected by Terna Spa - year 2021)

In 2021, the number of power generation plants/installations were as showed in following Table 23.

Table 23. Number of installations, by energy source used (data from ISPAT - originally collected by Terna Spa - year 2021; thermoelectric plants data from APPA, 2020)

Source	Plant/Installation type	N. plants/installations
Fossil fuel	Thermoelectric with (fossil) cogeneration	67 (*data from 2016*)
Renewables	Hydropower	280
	Wind power	8
	Photovoltaic	19,271
	Biomasses	43

For centuries, the rushing water of mountain watercourses had caused floods, but it had also been an important resource for the mountain economy. By the end of the 19th century, the availability of water fostered new perspectives, as it gave access to an energy source that could help in diminishing the gap between the Alpine economy and the economy of more developed surrounding areas. A series of initiatives began a true "hydroelectric epopea" that changed numerous Alpine territories (Leonardi, 2014). Today, hydroelectric production is the most prominent renewable energy production of Trentino. The production in the last years is presented in Figure 63.

Table 24. Hydroelectric normalised 15-year production in ktep and GWh from the Provincial Environmental and Energy Plan, 1st monitoring report (APRIE, 2021, data from TERNA S.p.A.)

Hydroelectric normalised production	2016	2017	2018	2019	2020
Ktep	372	362	368	368	379
GWh	4,326.36	4,210.06	4,279.84	4,279.84	4,407.77

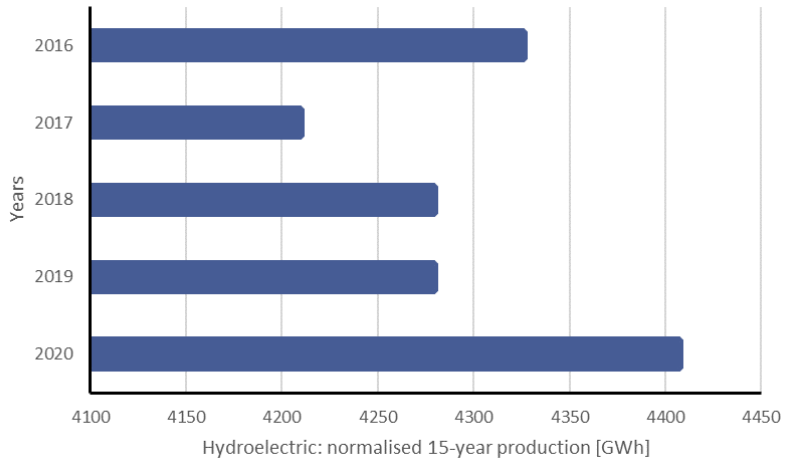


Figure 63. Hydroelectric normalised 15-year production in GWh from the Provincial Environmental and Energy Plan, 1st monitoring report (APRIE, 2021; data from TERNA S.p.A.)

The renewable source that contributes to meeting heat demand for Trentino is biomass as the contribution of solar thermal is still negligible. In Trentino, usage of wood biomass plays an important role, where mountain communities were dependent on the forest for self-production and consumption of wood. According to data from 2014-2016, the production of thermal energy from wood biomass is by far the greatest part (130 ktoe: 83%) produced in domestic heating plants (predominantly as a secondary contribution to a fossil source). While the district heating sector (10 ktoe: 6%) and the hotel/industrial sector (17 ktoe: 11%) use wood biomass prevailing in form of wood

chips and, in smaller quota, pellets, the domestic sector still heavily relies on broken wood (APPA, 2020d) (Figure 64).

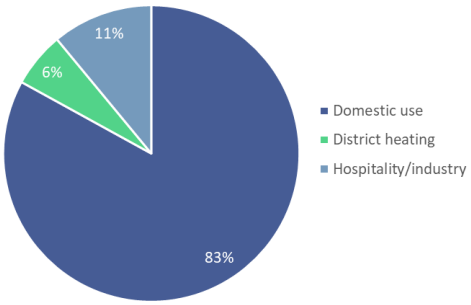


Figure 64. Production of thermal energy from wood biomasses, identified among production sectors (APPA, 2020b)

Data from 2016, gathered for the development of the Provincial Environmental and Energy Plan 2021-2030 and for the 2020 Report on the Environment of the Autonomous Province of Trento, showed that highest energy consumption in Trentino comes from civil (40-43%), transport (30-33%) and industrial (24-25%) sectors. Energy consumption uses different sources: oil derivatives cover almost all of the transport needs, while the industrial sector consumes mainly gas (about 60%) and electricity (about 40%). The Autonomous Province of Trento imports about 68% of the energy used, that mainly from locally non-available sources such as natural gas and oil products. Major part of the energy demand is located on oil products (37%) and natural gas (31%), carbon is not present (0%) while electric energy demand takes 20% of the share (plus a network loss of 1%) which use has increased slowly since the beginning of the 2000s (Figure 65). With regards to the provincial energy balance of 2016, the electricity balance is considered very green. Production (mainly form hydropower) exceeds consumption by 65% and great part of it is exported. Figure 66 shows the total energy consumption.

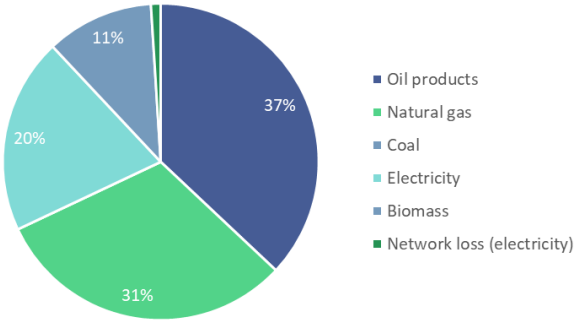


Figure 65. Final consumption of energy divided by source (mean data for 2014-2016) (APPA, 2020 - Report on Energy, original data from APRIE)

Figure 66. Total Energy consumption for the Autonomous Province of Trento, million kWh (1996-2021) (data from ISPAT - originally collected by Terna Spa)

The industrial sector, which includes also the touristic sector, in Trentino is the economic field with the greatest need for electricity. Energy consumption in this sector has remained fairly stable in recent years, while an important increase in demand is highlighted for the tertiary sector (Figure 67).

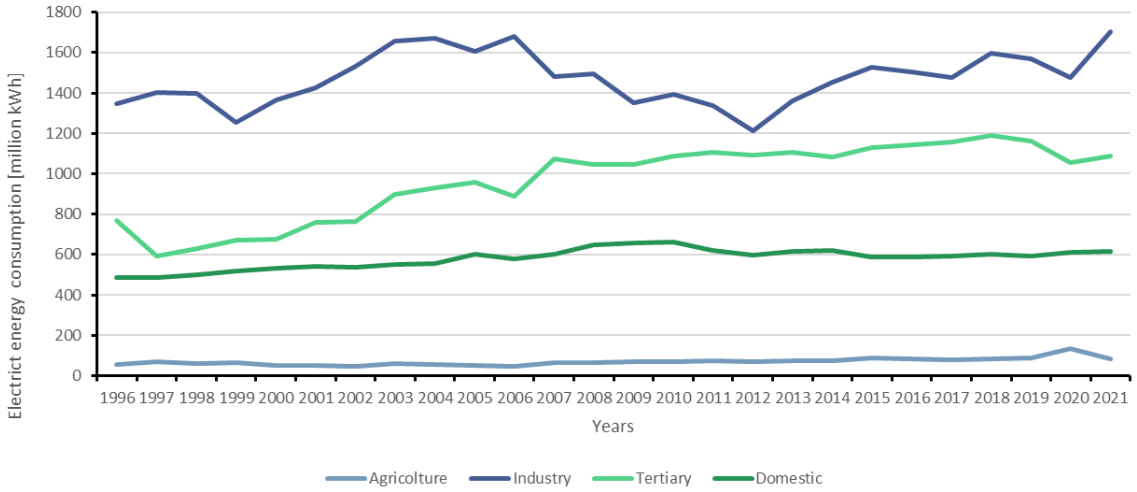


Figure 67. Energy consumption divided by sectors for the Autonomous Province of Trento, million kWh (1996-2021) (data from ISPAT - originally collected by Terna Spa)

Focusing now on the tourism industry and energy demand, the consumption for the touristic sector particularly for electricity can be recalled in Table 25, showing a strong increase particularly in 2019, while 2020 has been defined by the Covid-19 pandemic and 2021 data are not yet provided.

Table 25. Electric energy consumption for the tourist sector for the Autonomous Province of Trento, GWh (2016-2020) (data from the PEAP 1St Monitoring Report - originally collected by Terna Spa)

Electric energy consumption for the tourist sector (GWh)	2016	2017	2018	2019	2020
	220.75	218.25	225.10	291.25	237.68

The winter ski industry, mainstay of the tourism income of Trentino (see chapter 1.1.1.2) relies deeply on specific climatic and natural conditions, and nowadays is considered the tourism sector most directly and more rapidly influenced by climate change.

Ski resorts are also characterised by considerable energy consumption (from multiple electrical, thermal and fossil sources) required for daily operational actions, such as ski lifts, heating for technical buildings, snow production and slope management. All these activities are energy-intensive and costly, and tourism players currently need to find new solutions and possible innovative strategies to improve their efficiency and, at the same time, increase the use of renewable energy sources, while also reducing CO_2 emissions. The INTERREG Smart Altitude project, with its Living Lab in Madonna di Campiglio – part of an important ski-area in Trentino, the Skiarea Campiglio Dolomiti di Brenta – has performed activities aimed at gathering data and developing monitoring platforms for increasing energy efficiency in the ski area. Data related to number of snow production systems managed in the ski resort was also collected (Figure 68). Viesi et al. (2023) recalls that the reasons behind this large increase and investment as due "*to climate change with the temperature increase and the reduction of snowfall, as well as the desire of customers to have slopes ready earlier in the Winter seasons (November) and continuously available until the beginning of the spring Season (April)*". These installations hence lead to an increase in energy demand. The ongoing challenge for ski resorts and for the winter tourism industry is to understand how to become more resilient to climate change while improving their overall operational efficiency in terms of energy consumption (Viesi et. al, 2023).

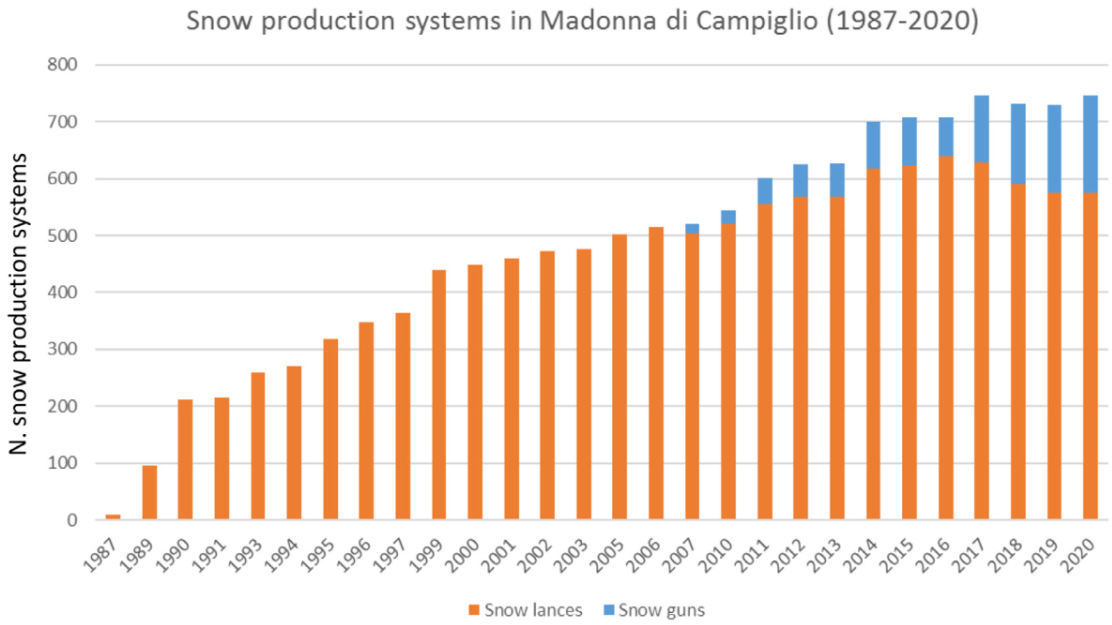


Figure 68. Snow production systems in Madonna di Campiglio (1987-2020) (Viesi et al. 2023)

As for the sector vulnerability and impacts of climate change, the increase in temperatures, expected in all seasons and more markedly in summer, is expected to cause a shift in energy demand also in the residential and service sectors – hence also in the operating of tourism activities. The need for heating in winter in homes and commercial and public spaces will tend to decrease, while the one for cooling in summer will tend to increase (APPA, 2022a). Recent studies conducted by Laiti et al. (2020) proved that in the latest decades, Trentino has showed an average reduction in the parameter of Heating Degree Days (HDD) of approximately -10 HDD year-1 and an increase for the parameter of Cooling Degree Days (CDD) that were estimated at a maximum of 5 CDD year-1. The variations in these climatic parameters correspond to an important seasonal reshaping of the energy consumption of the territory's civil buildings, which will – consider the authors - balance out at least partially on an annual basis. Estimations show a HDDs decrease between -4% and -11% (from 2016 to 2030), while CDDs estimates show an increase in percentage value between +12% and +36% from 2016 to 2030 This might lead to changes in energy demands both in winter (for heating) and summer (for cooling).

The assessments adopted in the Provincial Environmental Energy Plan 2021-2030 and the development of local energy scenarios indicate that climate change will leave the total amount of hydropower demand substantially unchanged over the next 10 years. As well, the Provincial decarbonisation scenarios for 2030 and for 2050 annexed to the same Plan envisage that at reduced CO2 emissions, electricity becomes the favoured energy carrier, enhancing 'green' generation not only for 'pure electricity consumption' but also in the thermal (with heat pumps) and transport (particularly due to the promotion of electric vehicles). The development of decarbonisation scenarios benefits from the important production of hydroelectric energy, which has been regarded as almost stable to 2030 and 2050 (2016 reference values: 4.32; Scenario 2030 LC/LC+: 4.45; Scenario 2050 LC/LC+: 4.76 [TWh/year]), while significant growth is seen only for photovoltaics (which, however, will also be of much less importance in the future than hydropower (reference values 2016: 0.18; Scenario 2030: LC 0.35 / LC+ 0.40; Scenario 2050: LC 0.74 /LC+ 0.93 [TWh/year])). Any changes in hydropower productivity could therefore impact the feasibility of future decarbonisation scenarios and the achievement of the targets fixed (for 2030 -55% CO_2 emissions compared to 1990 and climate neutrality in 2050) (APRIE - Annex 03, 2021).

A recent Report of the Autonomous Province of Trento published late December 2022 titled “Climate Change in Trentino. Observations, future scenarios and impacts” summarized key impacts for the

sector. It states that consequences of climate change may not significantly affect annual hydropower production in the short term, but they do set the conditions for more careful planning now, in view of changes in seasonal regimes and possible more intense changes in the medium and long term.

Future changes are likely to require a revision of strategies and procedures related to the management of reservoirs for hydroelectric use, also for flood lamination and the buffering of prolonged low water events. The same Report recalls a likely increase in the frequency and intensity of extreme weather events that might affect the security of energy infrastructures. These impacts, for example, could affect the reliability of the electricity supply, in terms of damage to the power grid but also to thermal power or renewable energy installations. The Report highlights also greater difficulties in the operational management of energy infrastructures, due, for instance to possible peaks in demand at certain times (particularly in summer), and/or difficulties in their implementation, as well as changes in the efficiency of production facilities due to high temperatures.

○ Tourism, leisure and cultural heritage

Tourism is one of the economic sectors with the greatest impact on the economy and quality of life in Trentino. The income connected, directly and indirectly, to this sector is, in fact, significant. The estimated contribution of tourism to provincial GDP is approximately 11%, a figure that does not consider day-trippers and the local impact of investments in the sector.

The importance of this sector also emerges from the number of certified (hotel and non-hotel) facilities and workers involved, with over 1,400 hotel facilities, corresponding to approximately 90,500 bed places, and about 10,000 employed workers, not considering the rental of private accommodation and the use of owned second homes that bring the number of accommodation facilities to approximately 73,400 and of bed places to 480,000 (ISPAT, 2020 and ISPAT, 2023).

It is important to highlight that tourism is probably the branch that is most integrated with the other local economic sectors. In fact, it is a highly transversal matter, capable of acting as a chain aggregator, which connects other topics and sectors such as environment, agriculture, culture, services, industry, mobility, energy, etc. It can be said that the connection with the other economic and social sectors is so close that if tourism went into crisis it would have incredibly negative effects on the whole local economy.

To better understand the characteristics and the role played by the tourism sector in Trentino, it may be interesting to report some data, starting with those relating to tourist flows. In 2019 Trentino recorded over 4.5 million arrivals and more than 18.4 million tourism nights, which rise to 6 million arrivals and 32.8 tourism nights if considering also tourists who have stayed in second homes. Although the Covid-19 pandemic led to a drop-in performance, the tourism sector is showing strong signs of recovery, with arrivals and tourism nights in 2022 approaching pre-pandemic levels (-1% and -3.6% compared to 2019) and with an average hotel stay of 3.8 days (4.5 days for non-hotel facilities) (ISPAT, 2023).

The Figure 69 below (ISPAT, 2023) shows the distribution of tourism nights (absolute values in thousands of people) by month in 2022, taking 2019, the last pre-pandemic year, as a reference. The information deriving from this figure is, on the one hand, the marked seasonality of the tourist phenomenon but, on the other, an improvement in performance in the spring and autumn months, which seems to highlight a trend of mitigation of this marked seasonality. In the future, it will therefore be interesting and necessary to verify whether this trend will remain constant and how the performance gap between the various seasons will change over time.

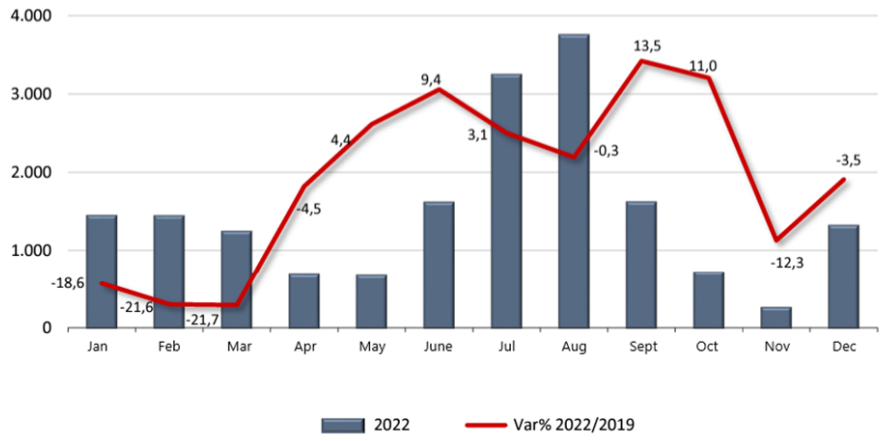


Figure 69. Distribution of tourism nights (absolute values in thousands of people) by month in 2022, and variation between 2022/2019

It is also important to underline that the difference in flows across the various months/seasons is already less marked for foreigners, for whom a less marked seasonality is recorded, while the proportion between inbound and outbound tourism has remained unchanged for some years, with about 40% foreign and 60% Italian tourists.

Another significant piece of information is the tourists-residents average ratio, which calculates the number of tourists who stay overnight in accommodation facilities per inhabitant. In the decade between 2005 and 2015 this numerical value remained substantially unchanged, oscillating between 29 and 30, but it then rose steadily until it reached 33.8 in 2019 (the most recent data is from 2021 with a value of 22.1 which, however, is still affected by the post-pandemic effects).

It could be also interesting to underline that these figures refer to an annual average and therefore include both the high and the low seasons. A similar reasoning can be made in geographical terms: again, in the annual surveys, there are significant differences in the data between the municipalities with a higher or lower tourist vocation. In 2019, for example, a municipality reached a 248.6 value while other localities recorded a 0 value, demonstrating that not only seasonal variations but also differences from place to place need to be kept an eye on. (ISPAT, 2021).

An interesting focus can be shared on the cableways that characterise the mountain touristic mobility on higher latitudes. The number of people transported by cableways increased significantly up to 2019 while it showed a rebalancing increase after the Covid-19 pandemic. Figure 70 shows the trend in the number of people on Trentino's cableways in operation between 1995 and 2020 during winter seasons. The increase from 1995 to 2019 is remarkable with a growth from 53 million to more than 81 million people in 2019. Even more interesting, however, is the figure relating to the growth in the use of these facilities in the summer season. Figure 71 shows the number of people transported on cableways in operation between 1995 and 2021 during summer seasons and, in fact, the growth shown by the figure is significant, rising from 1,750,000 people in 1995 to 5,069,000 people in 2019.

Moreover, it can be stated that the lifts usage rate is directly related both to the increase in the number of cableway installations open in the summer season (which were 40 in 1995 becoming 70 in 2021) and to vehicular traffic and tourist nights, while a trend reversal marks the winter season, where there were 225 active cableways in 2020 compared to 264 in 1995.

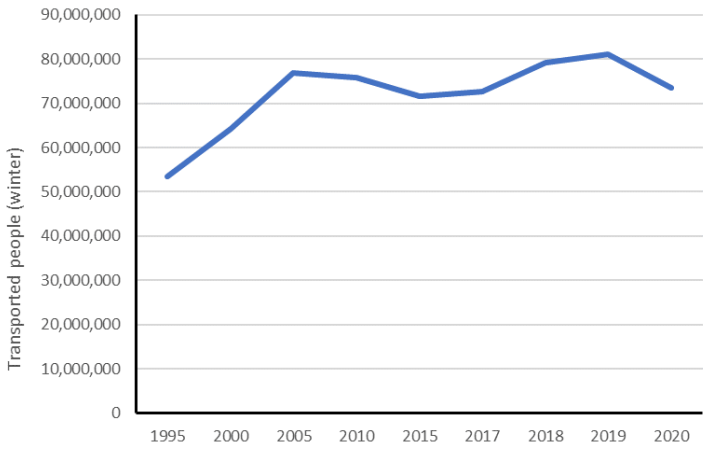


Figure 70. People transported in cableways during winter seasons (ISPAT data)

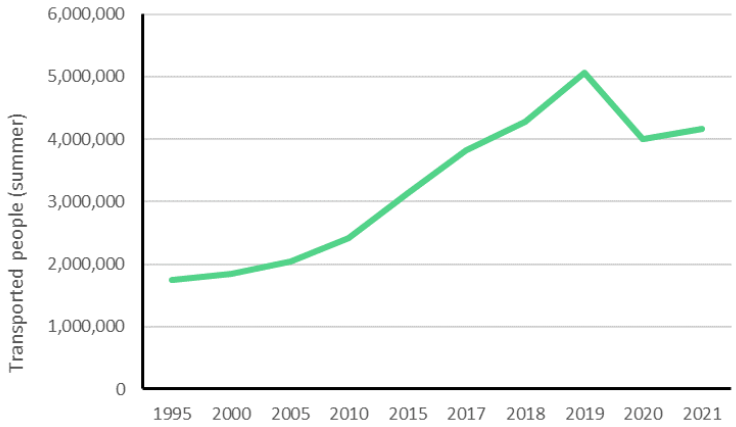


Figure 71. People transported in cableways during summer seasons (ISPAT data)

To complete a first, introductory description of the tourism sector in Trentino, it may be useful to provide some information on the tourist offer. Many of the following data will be explored further in the Biodiversity and natural heritage section, but they may be useful to understand how tourism in this area strongly depends on the quality of the natural environment. In fact, it is important to keep in mind that the main tourist products in Trentino are strongly linked to the climate and the natural environment, as guests reach Trentino and the Dolomites mainly to ski and to enjoy the snowy landscape in winter and to practice a wide range of outdoor sports or to enjoy an unspoiled nature and pleasant mountain temperatures in summer. That means that, if we consider the importance of the tourism sector in the local economy and the fact that in Trentino tourism is closely linked to nature and the environment, we understand how they represent the central elements to be preserved and valued. Sustainably planning tourism and safeguarding environmental resources are, therefore, as well as the most ethical choices for the planet and for the local population, the best ways to guarantee profitability.

It is important to preface that it would be almost impossible to list the entire Trentino tourist offer, which includes cultural sites, fine food and wine and cultural heritage, events and initiatives, and much more, but it may be useful to list the main natural elements that contribute to attract tourists from all over the world, starting from the Dolomites, that have been declared a UNESCO United Nations World Heritage Site, to the 297 lakes.

Wanting to focus on the importance of the natural element at the base of the local tourist product, it can be for example significant to underline that the forests of Trentino, 76% of which are publicly owned, cover over 63% of the land and they are so lush that there are over 1000 trees per inhabitant.

Moreover, over 30% of the land is subject to environmental protection thanks to three Natural Parks and an extensive network of about 400 protected areas, called “Sistema delle aree protette in Trentino” (System of protected areas in Trentino), all making up a truly safe haven for biodiversity. What’s more, there are over 120 animal species protected under the European Habitats Directive. The entire system of protected areas has worked with local actors on matters of sustainable tourism, becoming certified under the European Charter for Sustainable Tourism (ECST).

With respect to the sector vulnerability and impacts of climate change, it will have impacts on both current tourist destinations and tourist behaviour. The main impacts on winter and summer tourism are described below.

Winter tourism

As a consequence of the higher temperatures, winter tourism may suffer due to the lack of adequate snow cover (extent and thickness of the snowpack) and the shortened period of the winter sports season. Therefore, negative impacts are expected on the entire winter economy and, in particular, on the skiing sector (ski lifts, accommodation, catering, rentals and ski schools, local businesses).

The lack or scarcity of natural snow, especially at low altitudes - in Trento, snowfall has been reduced by 38% between the period 1961-1990 and the period 1991-2017 (APPA, 2020d) - could lead to increasing demands for water for snowmaking by ski resorts, increasing the risk of conflict situations in dry or drought winter periods.

A recent study conducted by the Bank of Italy shows that there is a positive and statistically significant correlation between snow conditions and winter tourist flows at 39 sample resorts in Valle d'Aosta and Trentino Alto Adige over the period 2001-2019 (Mariani and Scalise 2022). Thus, a negative impact of climate change is expected on ski pass sales and overnight stays in the winter period at resorts related to the ski industry, especially for resorts located at low altitudes and with unfavourable exposure.

Summer tourism

Rising summer temperatures could encourage an increase in tourist flows to mountain resorts due to the milder climate compared to the plains and urban heat islands. There will probably be a lengthening of the summer tourist season, as there will be more favourable weather conditions for outdoor activities in the spring and fall seasons.

On the other hand, it is expected that as a result of climate change there will be a decrease in forest cover in some mountain areas (Bizzarri and Pedrana 2017), an increase in zoonoses and allergies, and a reduction in water resource availability, which will have a negative impact on mountain outdoor and leisure activities.

The increasing frequency of dry periods leads to critical situations for water supply in the agricultural sector, but also for civil uses in some villages and mountain huts. Water scarcity also affects hydropower production, tourist activities related to the usability of beaches and bathing water, as well as water sports and leisure activities in waterways (e.g., rafting, kayaking, canyoning, and more).

The environment will be transformed in terms of landscape due to the melting and retreat of glaciers, the change of forests in terms of extension and composition, and the modification of the territory due to extreme events, as happened in the case of storm “Vaia” in 2018.

The increasing frequency and intensity of extreme events could affect the tourism sector due to the damage caused to mountain huts and trails network (as shown in the report shared by the Autonomous Province of Trento - Servizio Turismo e Sport “Analysis of the needs of mountain huts”, 2022) as well as transportation and communication infrastructures.

○ Water and waste

Water resources are a key asset for Trentino's local development both in terms of civil use, energy, agriculture and touristic attraction and destination identity.

Trentino's hydrographic system is extremely conditioned by the area's morphology, characterised by wide glacial valleys, surrounded by rocky and steep slopes and engraved valleys with moderate slopes. Trentino's territory is also furrowed by a dense network of watercourses, commonly with torrential features (APPA, 2022b). The total surface area of the principal and secondary watersheds in Trentino equals 6,354 km^2. Principal watersheds are the Adige, Avisio, Brenta, Chiese, Cismon, Fersina, Noce, Sarca, Vanoi rivers which cover an area of 6,167 km^2, while secondary watersheds count for the Astico, Cordevole, Illasi, Isarco, Senaiga, etc. Rivers that cover an area of 186 km2. In total, the Trentino water system consists of a network of 377 river bodies (Figure 72). The Alpine morphology of Trentino is home to some 297 alpine lakes, with a total surface area of 35 km^2, almost all originated to the direct or indirect action of glacial shaping (APPA, 2020e; APPA 2022b).

With regards to underground water bodies, Trentino can be divided in three hydrogeological complexes: between the alluviums of the main valleys; the limestones, such as the sedimentary calcareous dolomitic massifs and the vulcanites, or the mountain groups of magmatic and metamorphic origin. There are 22 underground water bodies in Trentino (APPA, 2022b). The 2020 Report on the Environment of the Autonomous Province of Trento also recalls that there are about 10,500 springs and 6,050 wells that have been surveyed (APPA 2020b).

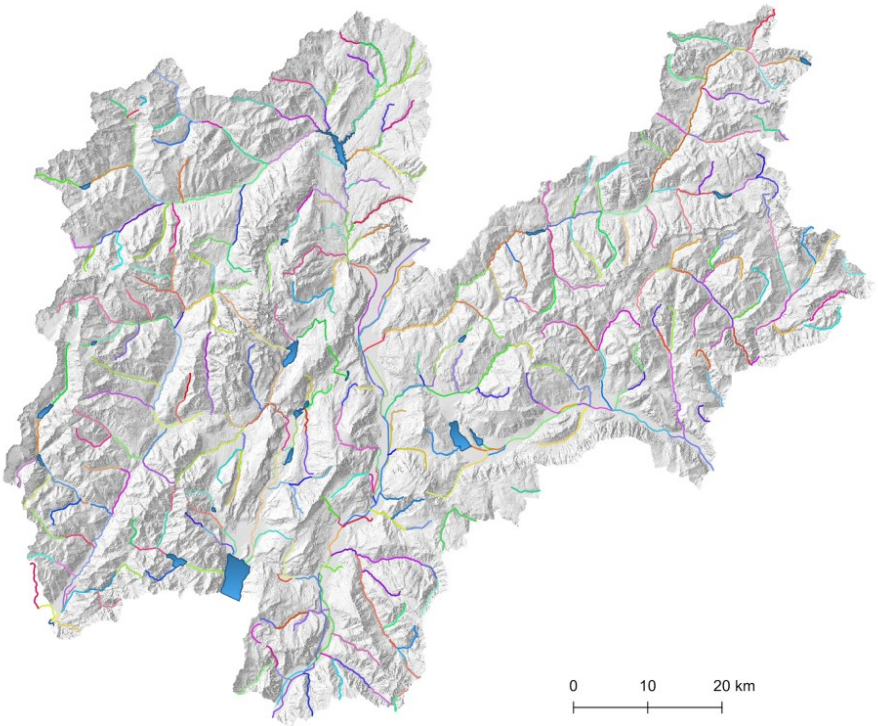


Figure 72. River water bodies and lakes in the Autonomous Province of Trento (APPA, 2022b)

Small, medium and also several large magnitude floods have always affected the territory, leaving just a few areas outside of the area of their occurrence. Thus, an extensive network of hydraulic works and soil defence systems have been set up to avoid and, where difficult to employ, to reduce risks. The creation of dams for the use of water for industrial or food purposes and later on for hydroelectric installations has transformed the landscape (APPA, 2022b).

In the Autonomous Province of Trento, water is managed through permits for water withdrawal and its use that must be always authorised by the Water and Energy Resources Management Service

(APRIE) (APPA, 2022b). Provincial estimates by APPA using ISPAT data for 2021 recall that water-use concessions amounted to a total of 19.892 million m3/year. The leading sector in terms of total authorised derivations is hydroelectric generation, with 18.759 million m3 (about 91% of total concessions of use) of which about 83% were associated with Large Hydroelectric Derivations (data from APRIE). This percentage includes all plants producing hydroelectric power, which range from large installations with regulating reservoirs to small plants running on smaller watercourses. In fact, energy production generally exceeds the provincial electricity consumption and since it highlights how water as renewable resource is strategic for the Province (further details are presented also in Energy section). It must be reflected, as suggested by APPA, that hydroelectricity represents a sector that does not actually 'consume' water, as this is entirely returned downstream of the production installation, albeit it alters the natural flow regimes to an even significant extent in the case of hydroelectric plants equipped with storage reservoirs.

Data, moreover, show that at the second place among water concessions (Figure 73) is the fish farming sector with 722 million m^3/year of water (3.6% of the total number of concessions in use), followed by agriculture with 585 million m^3/year or 2.9%, civil uses with 318 million m^3/year or 1.6%, industry with 123 million m^3/year or 0.6% and artificial snowmaking with 8.4 million m^3/year or 0.04% (ISPAT data for 2021, APPA, 2022b). Civil use for the Case Study is particularly influenced by demographic trends - in fact Trentino's population is unevenly distributed over the area, with a polarisation towards the settlements on the valley bottom which hence determines an unbalanced situation in water usage (APPA, 2022b).

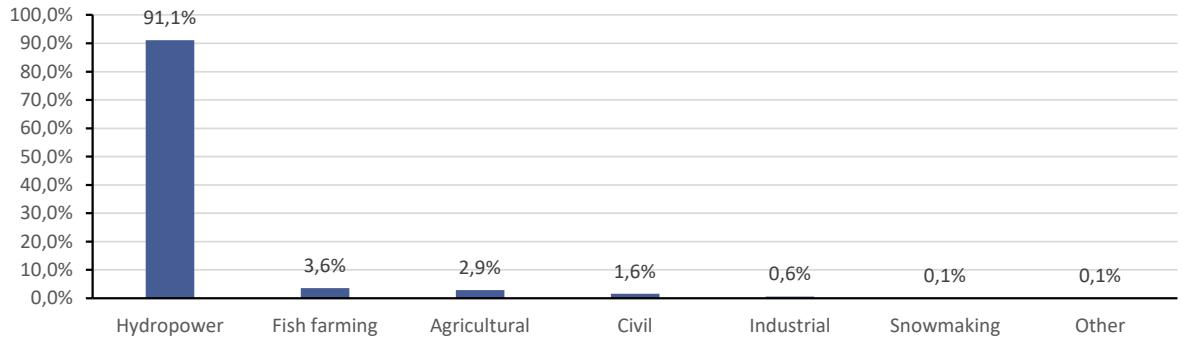


Figure 73. Quantity of water conceded for different uses [million m3/year] (data from 2021; ISPAT)

Estimates of daily per capita consumption of drinking water provided by ISPAT, the provincial statistical service, indicate 217 litres/inhabitant/day and manage to count tourism presences throughout the year. On the other side, national statistics collected for future environmental reports of the Province present higher estimates for the per capita consumption which might suggest the impact of tourism presences.

Trentino's aqueducts supply quality water to 99.5 % of the population of Trentino but systems have been found to be very fragmented with a capillary supply system. This characteristic makes the system prone to inefficiencies with average network losses that can be estimated at 38% (a value that provincial reports estimated with the ratio between the volume supplied and the volume fed into the network). This value, however, is not representative of the real state of efficiency of the aqueducts. Moreover, in the light of the climate change, the topic of water saving and the related issue of leakages of aqueducts, is becoming more and more relevant (APPA 2022b).

Considering the tourism industry and water demand, in Trentino, water environments represent landscapes and views of great beauty with significant tourist attraction. Nonetheless, tourism is linked to the consumption of water resources for the satisfaction of water needs for civil use, also for the needs linked to the production of artificial snow during the winter period. There is also a third use

which is not linked to water usage but to the need to ensure water quantities in riverbeds and lakes to promote Trentino's landscape and to respond to the expectations of those who visit the area. It is hence also important to take into consideration the recreational uses around water such as boating, fishing, water sports and bathing, activities which complete the tourist attractiveness of the area and help targeting an "all-season destination".

Due to climate change, the amount of snow and its permanence on the ground are decreasing, especially in valley floors and at lower altitudes, with a reduction in the average seasonal snow depth and with consequent negative impacts on winter tourism and more specifically on the ski sector (APPA, 2022a). According to the latest available estimates by Legambiente (2023), Italy is one of the Alpine countries most dependent on artificial snowmaking, with 90% of ski slopes being artificially snowed and 142 artificial reservoirs used mainly for snowmaking. Snowmaking is today an essential activity for some ski resorts, as showed as well by the increase of snowmaking installations around ski resorts (Viesi et al., 2023) (Figure 68). Snow production is strictly linked to the availability of water used to produce it and the energy used to refrigerate water and the systems when temperatures are above technical needs. So far, the established practice in the operation of snowmaking systems, if the environmental conditions permit it, involve the delivery of large quantities of water in a short period of time, and in most cases, these can only be ensured by the presence of reservoirs (APPA 2020d, APPA 2022b).

According to the latest Report on the Environment produced for the Provincial Water Quality Protection Plan (2022-2027) the total accumulation potential available in the Autonomous Province of Trento, also considering recently built and planned reservoirs for various purposes, is equal to 1,578,000 m3. On one hand, the creation of reservoirs at high altitude ensures the correct timing and mode for the availability of water for snowmaking. Reservoirs contribute to increasing resilience against climate change and can serve as storage for other uses. On the other hand, the construction of major excavations at high altitudes can lead to possible impacts on local aquatic ecosystems (APPA, 2022b).

Furthermore, high-altitude mountain huts are fundamental in the garrison of the mountains and are pivotal elements in the mountain tourism offer in Trentino. These have, also, a strong symbolic value in local marketing strategies. In 2022 there were 74 active mountain huts listed on the provincial database of mountaineering facilities. In March 2022 a Report developed by the Autonomous Province of Trento analysed the needs of these alpine huts to better understand how their setting is changing due to the challenges posed by climate change and to understand also how expectations of mountain visitors evolve. Results gathered by the Report show that in the last 20 years, 76% of the mountain huts have experienced problems with water shortages as a result of climate change. Since, the most frequent interventions to tackle the problem have been the laying of storage tanks and the adaptation of catchment works, while only a small number of huts have carried out works to store rainwater. During the summer of 2022, a season characterised by an exceptionally low rainfall and high temperatures, the Trentino Mountain Hut Managers' Association, already in July, expressed concerns about the critical water supply situation, which prevented hikers and mountaineers from being adequately accommodated, especially for those mountain huts that were not connected to the aqueduct network. Similarly, there were inconveniences in huts supplied by electricity provided by their hydroelectric power installations (PAT- Servizio Turismo e Sport, 2022) where some of these structures supply on melting snow from nearby glaciers and summer snows.

As per the sector vulnerability and impacts of climate change, the most recent Report on Climate Change for the Autonomous Province of Trento (APPA, 2022a) clearly summaries impacts on diverse water environments and on the water resource. With regards to rivers and streams, reduced snow cover, rising temperatures as well as high seasonal variability of precipitation will modify the hydrological cycle of water systems, presenting also threats for biodiversity and ecological statuses.

Alpine streams and rivers will see a decrease in the input from glaciers, while watercourses downstream will see increased frequency and duration of low and dry periods. This will result in an alternation of winter flooding and summer eutrophication in rivers further downstream, while, more generally, there will be a deterioration in water quality with consequent loss of biodiversity. On deep lakes, the increase in temperatures will induce an increase and anticipation of spring microalgal blooms. This will lead to further consequences to the entire trophic network. Less precipitation and greater warming could cause the progressive shrinkage, up to complete disappearance, of high-altitude lakes that depend almost exclusively on wet deposition, as well as the alteration of the temperature of their waters and the reduction of the period of coverage of their surface by ice and snow. The same Report recalls for possible consequences to these particular ecosystems with: changes in the mixing period, changes in the composition of plant and animal communities, loss of species or colonisation by species that habitually live at lower altitudes, loss of valuable habitats, endemics and constituents of the mountain landscape. While the reduction in the volume of high-altitude lakes could be offset, at least temporarily, by the development of various new proglacial lakes at the edge of melting glaciers.

Information currently available through monitoring, bear witness of a large-scale deglaciation, which to date seems unstoppable. The total extent of Trentino glaciers in 2015 was around 32 km2, corresponding to only 28% of that occurring at the peak of PEG (Little Ice Age, 1800) which was around 123 km2. This intense process of retreat has resulted in the fragmentation of the glaciers, which increased in number although becoming smaller and smaller, henceforth more vulnerable. For example, Figure 74 shows the historical series of mass balances carried out on the Careser Glacier from 1967 to 2018: since 1981 the glacier has been in continuous regression. For Trentino there must also considered some degradation phenomena of permafrost. The Province, in 2001, started monitoring some of the main rock glaciers, formations linked to the presence of permafrost. The results show a cumulative displacement of these debris bodies of more than 6 m, while monitoring showed also an acceleration from 2008 (APPA 2020e, APPA, 2022b).

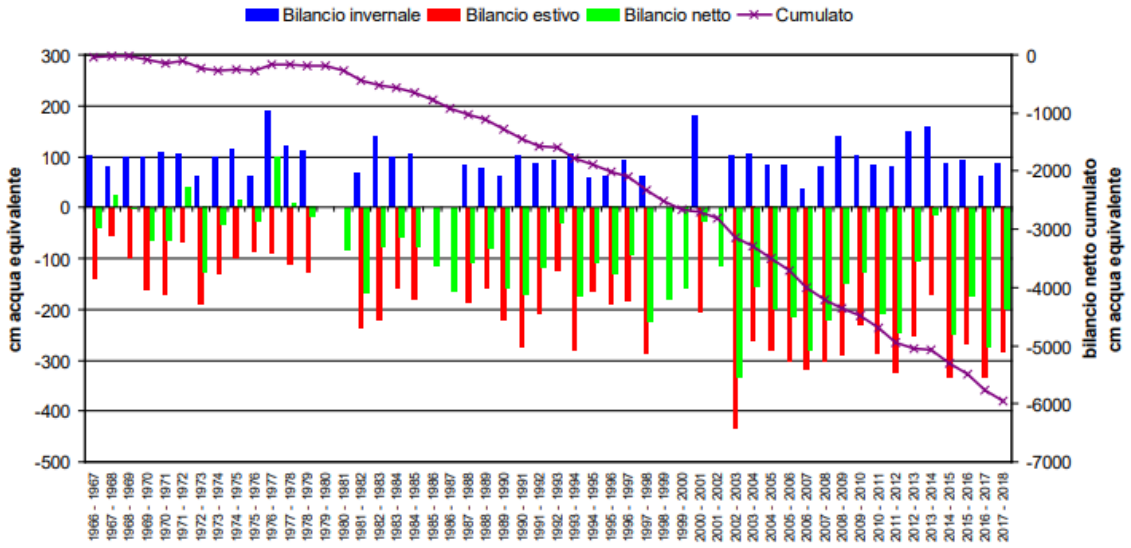


Figure 74. Careser Glacier mass balance (1967-2018) (APPA, 2020e)

The dramatic situation of the Trentino and Alpine glaciers also raises serious concerns regarding the future availability of water resources for the territories downstream. In light of changes observed and expected the depletion of glacier water reserves at high altitudes adds up to the occurrence of prolonged drought situations. This might lead to conflicts in the use of the resource, which have also emerged for instance during the latest 2022 summer season. Exceptional low water situations have occurred in all the hydrographic basins of Northern Italy since the spring of 2022. Trentino, too,

suffered the effects of this situation during the summer months, with the large reservoirs for hydroelectric use reduced to a minimum, with localised situations of water shortages for civil use and dry streams and with several release requests of water for irrigation purposes, also from lowland territories (Barbiero R., Laiti L., 2022). In fact, recent bulletins (April 2023) from the Italian Drought Observatory show that for the Italian great northern lakes, where the situation was very worrying until mid-April 2023, began a slow improvement that brought the other major Italian lakes Maggiore, Como and Iseo lakes to above-average values, while the Garda lake - as of mid-May 2023 – was at still at 48.6% of filling.

The effects of climate change predicted for temperature and rainfall regimes shows changes in the availability of water resources, altering the extent and seasonality of runoff in surface watercourses. Therefore, water deficits could be seen in summer, in line with the increased competition between the different uses: an increase in drinking water use connected to the increasing population due to tourist flows, the storage of water in reservoirs intended for hydroelectric energy production or due to the increased irrigation needs for agriculture. Since, the same Report on Climate Change of the Autonomous Province of Trento suggests for a different and careful planning of water resource management. These circumstances will ask for the prioritisation of a coordinated and integrated management of the water resource, in a transboundary way, across different sectors such as agriculture and hydropower production. Finally, the increase in extreme events such as floods or droughts will also ask for an adaptation of water resource management policies, regarding the management of reservoirs and releases for flood lamination and/or the control of runoff in riverbeds during water scarcity events (APPA, 2022a).

○ Biodiversity and natural heritage

The Autonomous Province of Trento has structured a complex and extensive system of protected areas that is at the forefront in Italy with 30.4% of its territory protected by a conservation tool (Figure 75). Three 'historical' parks are the backbone of this system as presented by the Protected areas Service:

- The Stelvio National Park, established in 1935 and covering 1,307 km^2. Its main objective is protecting the flora, fauna and the landscape of the Ortles-Cevedale Mountain range, and to promote the development of sustainable tourism in its alpine valleys.
- The Adamello Brenta Natural Park, established in 1967 and enlarged in 1987, the local protected area extends over 625.83 km^2 in eastern Trentino. It includes the entire Brenta Group (Dolomites World Heritage Site) and part of the Adamello-Presanella granite massifs, where there are important glaciers. It was designated as a UNESCO Global Geopark in 2015.
- The Paneveggio Pale di San Martino Nature Park, established in 1967 and enlarged in 1987 is another local protected area that extends for 191 km^2 in the eastern part of Trentino. To the north, the park is defined by the slopes of the Lagorai and those of the Cima Bocche Group, and by valley of the Travignolo stream which is home to the Paneveggio State Forest. To the east it includes part of the Pale di San Martino Dolomite Group (Dolomites World Heritage Site), while to the west it includes the eastern offshoots of the Lagorai chain and the Cima d'Arzon mountain range (Aree Protette, 2023).

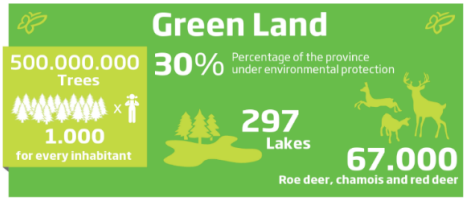


Figure 75. Promotional infographic of the Autonomous Province of Trento on natural assets (land distribution and percentage under environmental protection) (Visittentino.info; data for 2020).

Trentino counts also for several areas with UNESCO designation: The Dolomites, listed as a UNESCO World Natural Heritage Site in 2009, the pile-dwellings sites of Ledro and Fiavé designated in 2011 and the Biosphere Reserve Ledro Alps and Judicaria, also recognised by the UNESCO Man and the Biosphere Programme in 2015.

The great naturalistic value of Trentino has also led to the identification and establishment of a multitude of other protected areas: 154 Natura 2000 areas, 46 provincial nature reserves and 223 local reserves many of them under coordinated management by Reserve Networks - 10 established to date which are the Alto Noce River Park, Sarca River Park, Reserve Network of the Chiese valley, Reserve Network of the Ledro Alps, Reserve Network of Avisio and Cembra valley, Reserve Network of the Fassa valley, Reserve Network of the Brenta River, Reserve Network of the Bondone, Local Natural Park of the Baldo (APPA, 2022b) (Figure 76).

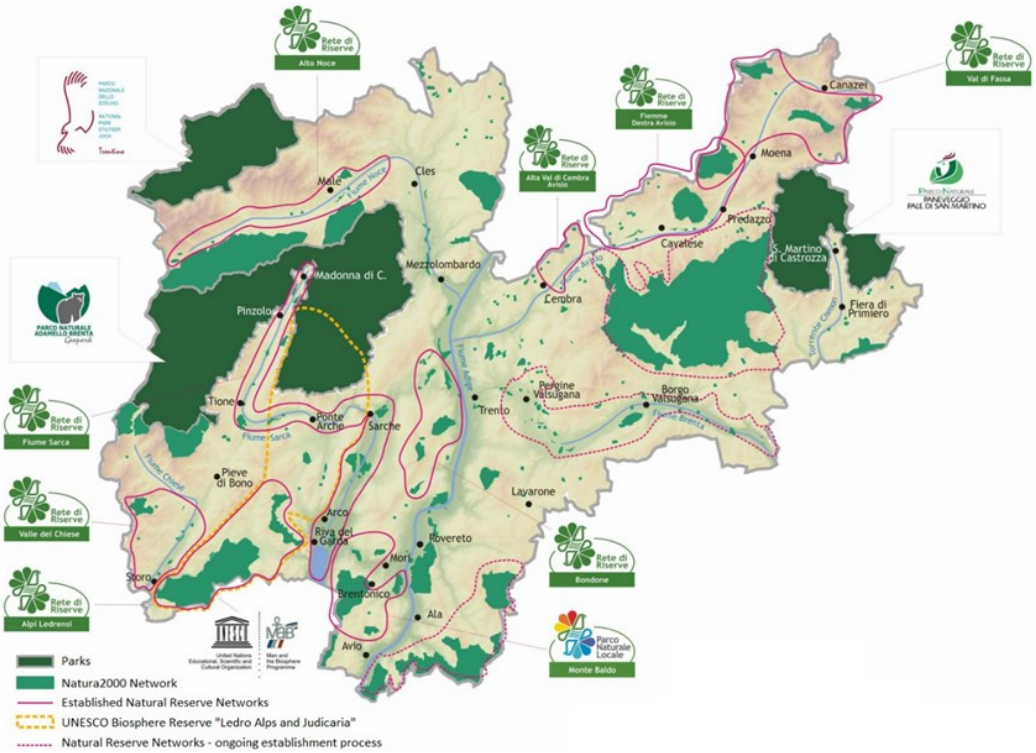


Figure 76. Protected areas in the Autonomous Province of Trento (2013-2019) (APPA, 2022b)

Table 26. Protected surface in the Autonomous Province of Trento (2013-2021) (ISPAT, 2023)

Years	Parks [ha]	Networks of reserves [ha]	Natural areas excluded from Natural Reserves			Total [ha]	% of the Trentino Province
			Established Natural Reserves and Local Reserves [ha]	Non-established reserved [ha]	Residual Natura2000 [ha]		
2013	99,326	32,049	542	168	62,679	194,764	31.4
2014	99,326	32,330	530	168	62,410	194,764	31.4
2015	99,326	34,540	500	168	60,230	194,764	31.4
2016	99,326	34,544	496	168	60,230	194,764	31.4
2017	99,326	34,544	496	168	60,230	194,764	31.4
2018	99,326	35,844	346	168	59,112	194,797	31.4
2019	99,326	38,008	336	168	56,959	194,797	31.4
2020	99,326	38,008	336	168	56,959	194,797	31.4
2021	99,326	38,008	336	168	56,959	194,797	31.4

Table 27. Type and size of protected areas. ***It should be noted that there is often overlap between the various forms of protection and, consequently, the algebraic sum of the individual values does not represent significant data (APPA, 2022b)***

Type of protected areas	Number	Surface [ha]
Natura2000 (SCI SPA SAC)	154	176 219
Non-established biotopes	29	1751
Provincial Natural Parks	2	81766
National Park	1	17560
Local Reserves	233	1317
Provincial Natural Reserves	46	3036

The establishment of networks and protected areas is at the core of biodiversity protection. Some 3724 animal and plant species have been recorded as well as this system of conservation areas fosters the quality of life, but, more and more increasingly, protected areas can generate opportunities for local sustainable development (Aree Protette, 2023).

Mountain areas of Trentino are a biodiversity hotspot thanks to their geographical position, the diversity of soils and a great variety of micro-environments. This boosts the presence of a variety of animal species, many of which are characteristic of the Alpine environment, such as - by way of example only - the Alpine chamois, the ibex and the Alpine brown bear, the lynx and the wolf**.** The Monitoring Report on Large Carnivore with data for the year 2021 show that a) it was possible to estimate a bear stock of around 100 specimens; b) the monitoring of the wolf began with the natural return of the first animal detected in the province in 2010, after its disappearance in the mid-19th century. Estimates recalls for a minimum of 26 herds (or family groups) whose home ranges, during 2021 touched at least part of the provincial territory c) the monitoring of the lynx began with the return of the lynx to the Province (having disappeared in the 19th century) from the second half of the 1980s and the only specimen that has certainly been present in recent years is one male (PAT – Servizio Faunistico, 2021).

Despite being one of the most inhabited mountain ecosystems in the world, the Alps remain one of the wildest and richest areas of biodiversity in Europe. The fauna that inhabits these areas, from the smallest invertebrates to large mammals and birds, has adapted to the rugged terrain and extreme altitudes. Plant communities range from forests to meadows and pastures. Meadows – very rich in species - are, in fact, maintained and developed thanks to a centuries-long tradition of cultivation and mowing. Protected areas, nowadays together with breeders and farmers, plan trails and implement synergetic actions to promote both nature conservation as well as local sustainable local development. Trentino protected areas are hence currently engaged in preserving this richness through the active conservation of the habitats where those live (Aree Protette, 2018).

Forests in Trentino cover an area of 390,463 hectares, or 63% of the provincial territory. The most represented forest types (in terms of surface area) are those with a predominance of spruce (32 %), beech (14 %), larch (13 %) and silver fir (11 %). Here forestry is a predominant element in the agricultural sphere (PAT - Servizio foreste e servizio Faunistico, 2023) (Figure 77).

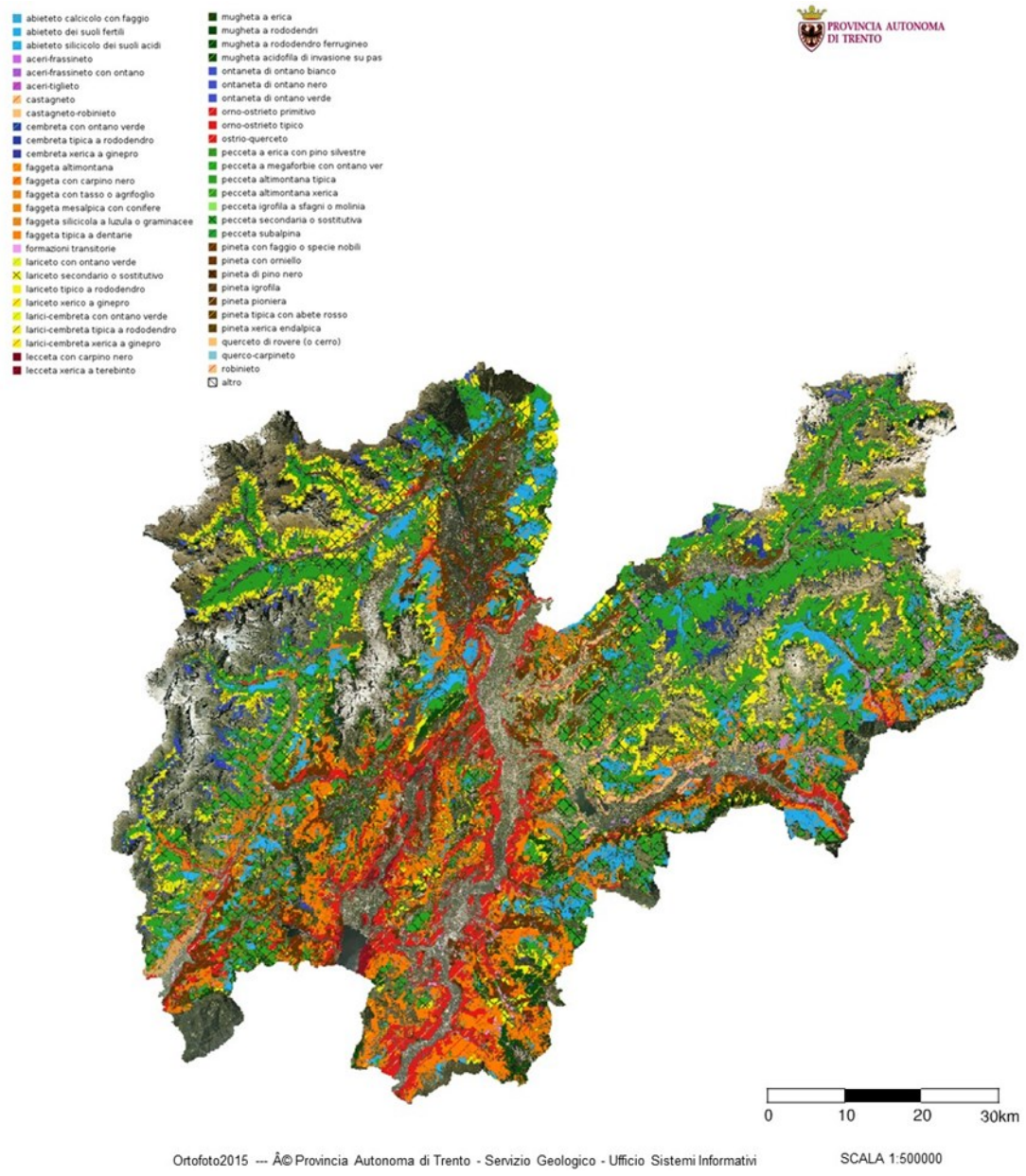


Figure 77. Forest types recorded in forestry business plans in 2022 (Autonomous Province of Trento, Forest Service, WebGIS, 2023)

Focusing on the tourism industry and natural heritage, Trentino's protected areas are increasingly committed to promoting a more sustainable tourism particularly inside their territories. Here, the European Charter for Sustainable Tourism in Protected Areas (CETS) has proved as a very effective tool. The CETS is an internationally recognised certification that attests to the management of sustainable, responsible and quality tourism in fragile environments such as protected areas (Federparchi.it, 2023) and has been awarded to all protected areas in Trentino.

The Paneveggio Pale di San Martino Nature Park obtained the CETS at the end of 2015 and in 2022 restarted the participation process with local stakeholders to renew this important certification. In 2019, Europarc officially notified the Stelvio National Park of the awarding of the Charter for the five-year period 2019-2023. The Adamello Brenta Nature Park, one of the first parks in Italy to obtain the CETS certification in 2006, has recently (24 May 2023) obtained the recognition for Phase Three, the highest available. In fact, in Phase One, it is the Natural Park that is warded with the Charter. In the second, the accommodation facilities that met the requirements, which leads to a significant work with

local stakeholders, mandatory for the recognition. In the third phase, tour operators and consortia are directly given the recognition. In addition to Natural Parks, the Reserves Network system have also been awarded the European Charter for Sustainable Tourism (PAT – Carta Europea del Turismo, 2023).

Natural environments provide important ecosystem services to society and local economies: resources such as clean water and wood, increased protection of land from natural disasters, and landscapes suitable for tourism and recreation. At the same time, these ecosystems are crucial for the preservation of biodiversity, ensuring, among other things, the survival and well-being of animal species. Of particular interest are the services linked with tourism, wellness and the recreational sectors (Aree Protette, 2018).

With regard to the sector vulnerability and impacts of climate change, Alpine territories are among the areas at high risk of biodiversity loss and to date have suffered very clear impacts. Indeed, the Report of the Autonomous Province of Trento titled "Climate Change in Trentino. Observations, future scenarios and impacts" (APPA, 2022a) states that climate change impacts the physiology, life cycle, disease resistance and geographical distribution of species, the composition of terrestrial ecological communities and some interspecies interactions. In Trentino as well, an acceleration of some effects can be expected in the coming decades, such as the raising of the tree line and changes in forest composition. The impacts of climate change on biodiversity foresee in fact variations in the structure, distribution and productivity of different habitats, with consequences on vertebrate and invertebrate fauna, soil, community structure, population distribution, genetic diversity, behaviour, reproduction and intestinal flora the modification of phenological cycles, with the anticipation of the flowering of many plants and the premature restarting of the vegetative period.

Moreover, for plant species, with the altitudinal rise their habitats become less optimal which might lead to population decrease or even to extinction. Water issues or thermal stress, or stress related to extreme events will cause greater spread of plant pathologies. Moreover, a spread of allochthonous and invasive species is expected including parasites and pathogens, which will contribute to an increased risk of extinction of populations and native species.

Locally, freshwater ecosystems are important reservoirs of biodiversity, whose ecological status is currently subject to significant anthropogenic pressures that cause loss of biological components, habitats and a general degradation of their natural conditions. Climate change acts on these ecosystems, already characterised by high vulnerability, and can amplify these effects leading to loss of species and ecosystem services, biological invasions and deterioration of water quality also linked with the release of past pollutants due to melting glaciers (APPA, 2022a).

4.1.2. Climate change factors analysis: adaptation and mitigation baseline

To evaluate the mitigation baseline in Trentino, we used to complementary approaches: data from the Autonomous Province of Trento (PAT) provided by the provincial Environmental Agency and data from the Emissions Database for Global Atmospheric Research (EDGAR[44]) were used. EDGAR provides emissions tCO_2 while PAT share emissions levels in tonnes of equivalent CO_2 which include other complementary sources of GHG as NO_x or O_3. The evolution of the emissions in Trentino using EDGAR data is presented in Figure 78.

[44] https://edgar.jrc.ec.europa.eu/

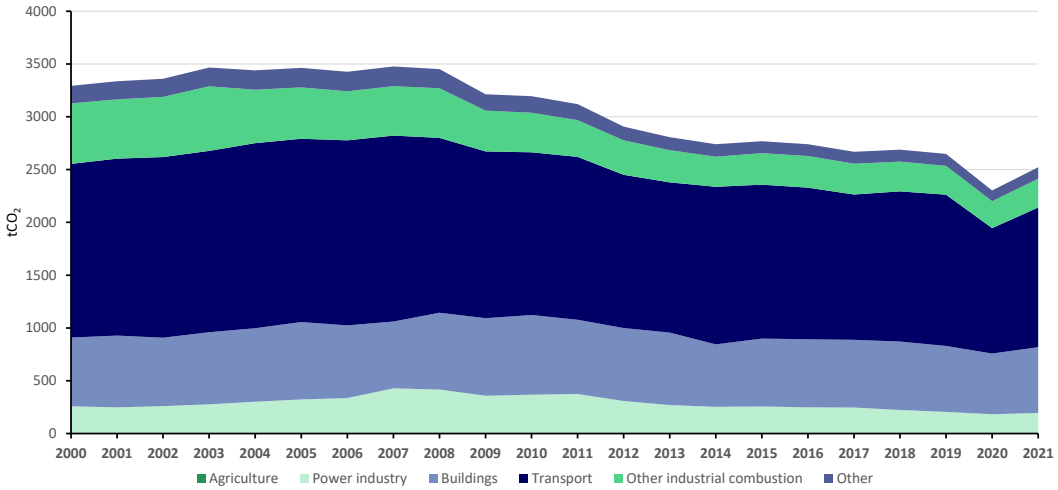


Figure 78. Evolution of CO_2 emissions in Trentino between 2000 and 2021. Source: Own calculation based on EDGAR data.

A more detailed analysis of the emission is provided in Figure 79 using the data from PAT. This data covers the years 2010, 2013, 2015 and 2019 in a more disaggregated way, clearly showing the stabilization of emissions in the evaluated period.

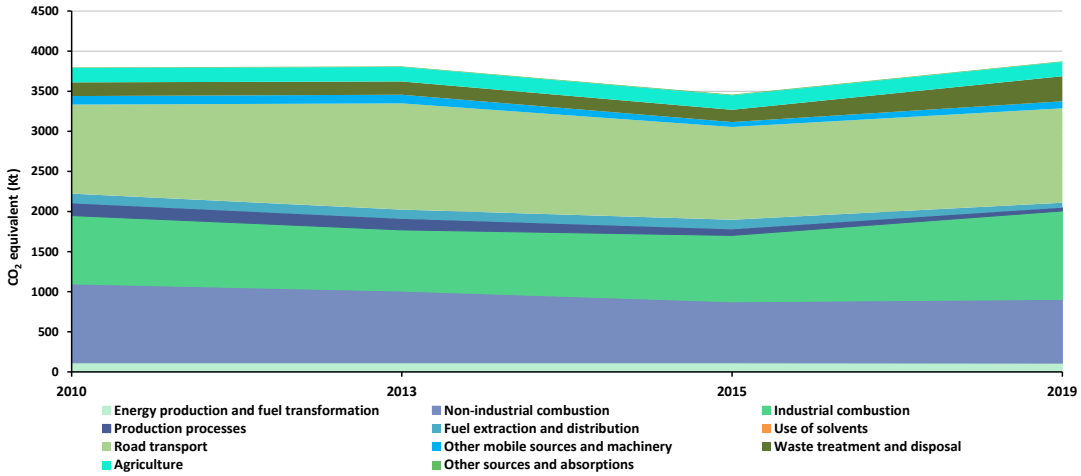


Figure 79. Evolution of CO_2 emissions in Trentino between 2010 and 2019. Source: Own calculation based on PAT data.

Considering the results presented in the previous figures, road transport and industrial combustion are the main CO_2 emitters in the region followed by combustion in buildings. Despite the fact that emission levels have decreased in the long term, in recent years this decrease has not been as visible, so it would be appropriate to continue implementing measures that help reduce emission levels in the case study.

Finally, to complement the emissions analysis, the carbon stock in vegetation and soil in provided (Figure 80) using geolocated data from ESA Biomass Climate Change Initiative[45] and Global Soil Organic Carbon Map (from FAO)[46], on soil organic carbon and biomass stock that was translated in carbon stock using default values provided by the IPCC. As a result, the carbon stock in soils is higher than 664043.33 $MgCO_2$, while the carbon stock in the biomass increases to 46905006.25 $MgCO_2$. The evolution of carbon stock in biomass along the year with available data is represented in Figure 81. It is observed how the carbon stock in the biomass has been reduced in a very visible way since 2010.

[45] https://data.ceda.ac.uk/neodc/esacci/biomass/data/agb/maps/v4.0
[46] https://data.apps.fao.org/glosis/?share=f-6756da2a-5c1d-4ac9-9b94-297d1f105e83&lang=en

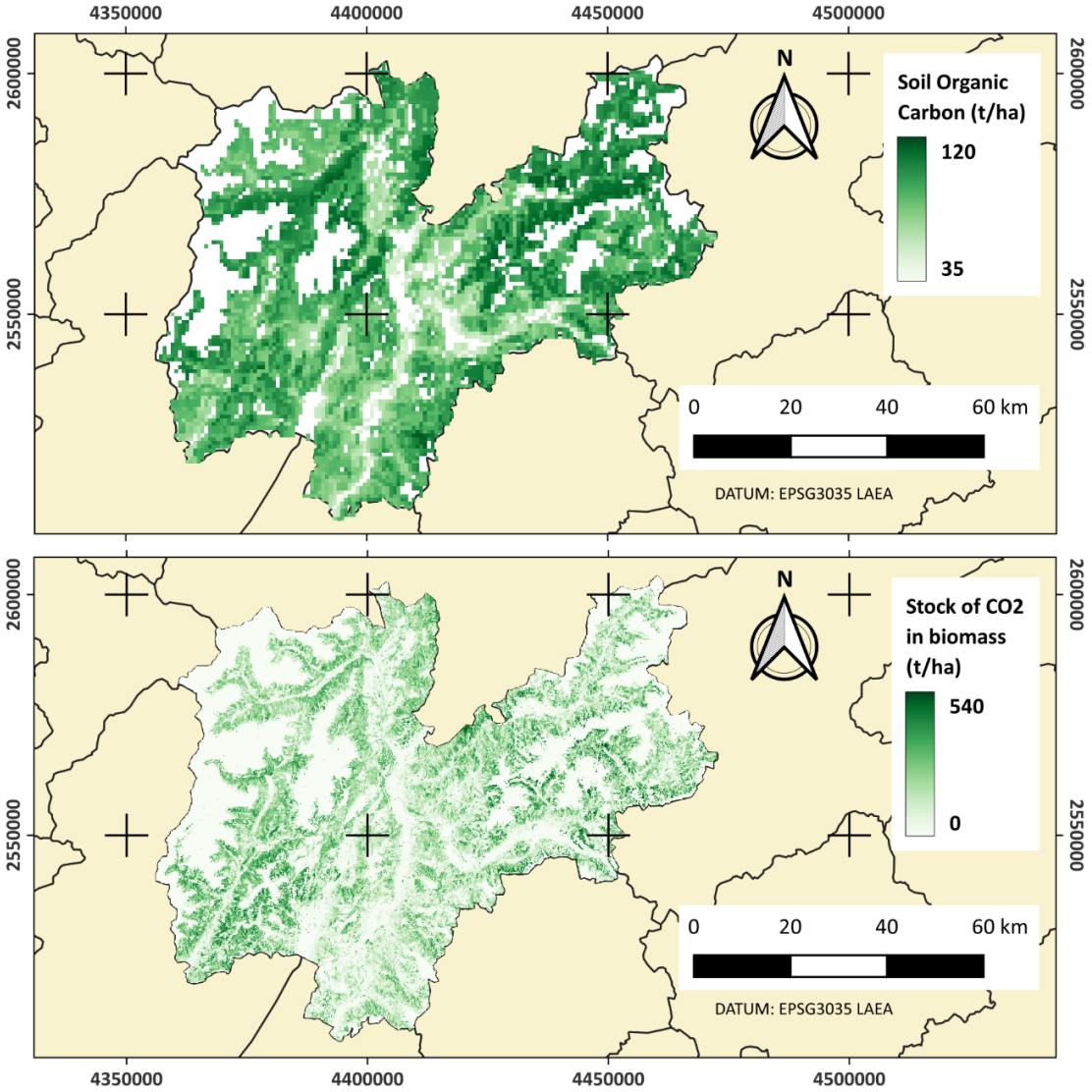


Figure 80. Carbon stock (tCO_2) in soils (top) and carbon stock (tCO_2) in biomass for Trentino in the reference year. Source: Own calculation based on ESA Biomass Climate Change Initiative and Global Soil Organic Carbon Map (from FAO) data respectively.

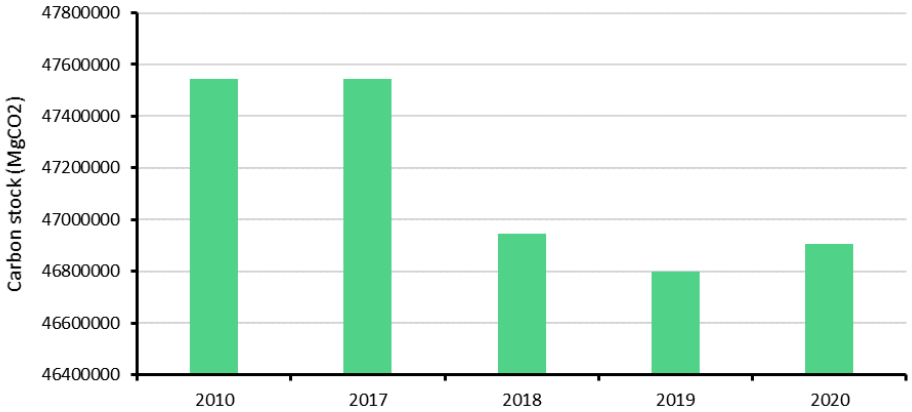


Figure 81. Carbon stock in biomass ($MgCO_2$) for Trentino between 2010 and 2020. Source: Own calculation based on Global Soil Organic Carbon Map (from FAO) data.

4.1.3. Past experience and legal framework analysis

For the past experience and legal framework analysis of Trentino Case Study, 27 documents were identified and high-level characterised within key fields. From them, 10 were selected as the most relevant and interesting ones, and were further analysed.

The detailed information of this analysis can be consulted in Annex 2 in section 11.3. Table 28 includes the relation of those documents analysed in more detail and a few key aspects on them. This legal framework will help to define the starting point for policy implementation considering the most important sectors and the associated climate change impacts.

Table 28. Relevant documents analysed for CS2 Trentino.

#	Name of the document	Type	Scope	Year	Main sectors
5	**The Italian National plan for adaptation to climate change**	Plan	National	2018	• Water and waste • Biodiversity and natural heritage • Cities and urban planning • Energy
7	**CLIMATE ACTION PLAN 2.0**	Plan	Regional	2020	• Tourism, cultural heritage • Transport • Biodiversity and natural heritage
8	**The Italian National Integrated Plan for Energy and Climate**	Plan	National	2019	• Energy • Water and waste • Cities and urban planning
9	**The Italian Long-Term Strategy for the reduction of greenhouse gas emissions**	Strategy	National	2021	• Energy • Transport
10	**Trentino Provincial Sustainable Development Strategy (Agenda 2030)**	Plan	Regional	2020	• Biodiversity and natural heritage • Tourism, cultural heritage • Agriculture, forestry and fishing • Energy
12	**Environmental Energy Plan of the Trentino Province**	Plan	Regional	2021	• Energy
17	Three-year plan 2022-2024 of Trentino Sviluppo S.p.A. on **Trentino's territorial promotion and tourism marketing activities**	Plan	Regional	2022	• Tourism, cultural heritage
18	**Dolomiti Paganella Future Lab**	Project	Local	2020	• Tourism, cultural heritage • Society
25	**Water Quality Protection Plan (2022-2027)**	Plan	Regional	2022	• Water and waste • Agriculture, forestry and fishing • Biodiversity and natural heritage • Energy
27	**Research and Innovation Strategy for Smart Specialisation 2021-2027 (of the Autonomous Province of Trento)**	Strategy	Regional	2021	• Energy • ICT
28	**GSTC certification (Global Sustainable Tourism Council)**	Other	Local	2019	• Tourism, cultural heritage • Society
29	**European Charter for Sustainable Tourism (CETS) phase III**	Other	Local	2023	• Tourism, cultural heritage • Society

4.2. PESTLE results for the local ecosystem drivers' analysis

This section discusses how the impact of climate change, and adaptation and mitigation policy implementation are affecting Trentino based on political, economic, social, technological, environmental and legal factors. Table 29 below provides details of the key items collected for each PESTLE factor. The sources for the information provided in the table are from the data collection results which came from the different exercises with stakeholders, the case study leader and supporter to identify the main drivers and the data sources to understand the local ecosystem (reported in section 11.4 Annex 4. Case Study 2 – Mountain Region (Trentino): PESTLE results for the local ecosystem drivers' analysis). The process to complete this PESTLE was explained in the methodological part of this document (section 2.2).

Table 29. Results from Trentino PESTLE analysis.

Factors	Category	Details	Impact status
Political	Governmental policy	Framework of mitigation and adaptation. ▪ Raise political awareness. ▪ Proactivity to control exploitation and activities related to the environment. ▪ Urban and sectoral planning. ▪ Wider governmental competencies. ▪ Provincial Energy and Environmental Plan. ▪ Water Management Plan.	Positive
	Environmental and population policies	Guidelines to improve awareness of climate crisis. ▪ Willingness of local authorities to make sustainable choices ▪ Restrictive land use plans. ▪ Regulation of depopulation. ▪ Sustainable tourism. ▪ EU-Strategy for the Alpine Region (EUSALP). ▪ Tourism Service's plan. ▪ Traffic policy.	Positive
	Necessary improvements	Better decision-makers activity. ▪ Consideration of the development of tourism.	Positive
Economical	Economic growth	Marketing strategy. ▪ Activities with fewer emissions. ▪ Promotion of winter activities	Neutral
	Economic investment and incentives	Incentive for electric mobility and electric cars. ▪ Incentives and investment on energy and water efficiency, PEAP. ▪ Funding for climate change adaptations actions. ▪ Rewards for recycling. ▪ Aid to modernise facilities. ▪ Facilitations for low-impact actions. ▪ Incentives for proactivity on cultural heritage. ▪ Incentives for renewable energy development. ▪ Stimulation and incentive to energy transition, to zero emissions.	Positive
	Initiatives	On corporative sustainability. ▪ Green community. ▪ Path to be a certified sustainable tourism district.	Positive
	Financing capabilities	Good economic conditions. ▪ National Recovery and Resilience Facility Funds PNRR.	Positive
	Tourism sector	Presence of high volume of tourism. ▪ Tourism Consortia business models. ▪ Innovation of the model. ▪ Sustainable management of tourist flows. ▪ Tourism Tax.	Neutral
	Restrictions	High volume of energy needed for artificial snow. ▪ Taxes to high-impact actions. ▪ Awareness of cost inaction and adaptation.	Negative
Social	Population	Depopulation. ▪ Safeguarding of the population of valleys. ▪ Quality of the education. ▪ Repopulation of mountain regions due to the increasing of temperatures. ▪ Development of Youth Adaptation Strategies.	Negative / Positive
	Health	Awareness of climate crisis and sustainability. ▪ Proactive society worried about environmental issues. ▪ Awareness of energy sector. ▪ Numerous protected areas (e.g. Geopark, UNESCO Biosphere Reserve or UNESCO World Heritage Site).	Positive
	Trends	Interest in digitalization. ▪ Consumer sustainable choices. ▪ Widespread of culture and information to increase awareness. ▪ Increased interest in smart-working and of workation (work + vacation). ▪ Creation of a transport network to reduce travel by own means. ▪ Enhancing the self-organisation of individuals and communities.	Positive
	Associations	Manage of some areas. ▪ Voluntary culture. ▪ Promotion of more sustainable corporate legal form. ▪ Presence of a rich social fabric of	Positive

Factors	Category	Details	Impact status
		associations, cooperatives, networks, etc. that do advocacy on the environmental issues they care about.	
Technological	Production	Artificial snow production. ▪ Technical solutions to store water at high altitude for multiple use. ▪ Solutions to reduce energy consumption related to mountain use.	Negative / Positive
	Considerations	Recovery of ancient know-how. ▪ Local agents involved on climate change adaptation/mitigation. ▪ Necessity of new solutions and model of hospitality-facilities services. ▪ Digital development.	Positive
	Potential investment	Financing self-sufficient facilities.	Positive
	Research & Development	Research centres dealing with climate change. ▪ Universities and research institutes. ▪ Presence of Innovation hubs. ▪ Participation in European projects related to climate change. ▪ Green Innovation Factory (e.g. Sustainability, energy, resources…). ▪ Sustainable mobility projects. ▪ Development of climate services and early warning systems. ▪ Improvement of energy sector.	Positive
	Energy and water	Increasing infrastructures for electric cars. ▪ Improvement of energy sector (e.g. renewable, efficiency, storage…) ▪ Water basins and water storage management. ▪ Water and energy monitoring.	Positive
Environmental	Impact and awareness	More severe and evident impacts. ▪ High exposure and vulnerability to risks. ▪ Improving management of territory to face extreme events. ▪ More awareness and action to climate change impacts. ▪ Awareness campaigns related to non-renewable resources. ▪ Permafrost degradation.	Negative
	Sustainability	Decrease in the availability of water. ▪ Development of reservoir for snow-making. ▪ Occurrences of invasive species. ▪ Change on energy consumption patterns.	Negative
	Positive business	Integration between renewable energy sources. ▪ Implementation of ESG strategies. ▪ Integration between infrastructure projects. ▪ Improvement of water use efficiency and management.	Neutral
	Carbon footprint	Project for self-production of food and fuel. ▪ Improvement and mitigation of heat islands. ▪ Creation of green systems with less water requirements.	Positive
	Protected ecosystems	Defined conservation and sustainable development objectives related to protected areas. ▪ Improvement of biodiversity management and ecosystem connectivity.	Positive
Legal	Legislation	Banning of unnecessary emissions. ▪ Ban of plastics. ▪ Urban plans. ▪ Specific laws for Natural Parks. ▪ Minimum share of Renewable Energy support in buildings. ▪ Single Provincial Authorisation Measure (PAUP) that includes the EIA (Environmental Impact Assessment) in projects.	Positive
	Future legislation	Climate change mitigation and adaptation strategy. ▪ Sectoral plans and programmes. ▪ Adaptation of laws to European targets. ▪ New Hazard Maps.	Positive
	Environmental legislation	Legal framework of protected areas. ▪ Reassess and regulatory simplification of protected areas limits.	Positive

Considering the **political factors**, we can see the relevance of plans and strategies as factors that help to stimulate the adoption of measures to reduce the impact of climate change through the reduction of emissions, a proper management of water and energy, and increase of social environmental awareness. Urban and sectoral plans related to control exploitation and activities related to tourism, as well as energy and environmental plans are also a driver for the adoption of sustainable policies, and a sample of the local authorities' willingness. Strategies, plans and initiatives to regulate tourism are also key to contribute to the sustainability of the region and its resilience.

Analysing the **economic factors**, the promotion of sustainable winter and cultural tourism and the energy transition interest serve to guide the population's capacity to become climate aware and advance in the decarbonization of the region's economy through the improvement in the use of resources. It must be considered that the GDP per capita in 2017 was 39,187 €, highlighting its increase

of 1.5% compared to the previous year. The regional GDP value is significantly higher than the national average (28,900 €), 35.6% higher. This may be indicative of a good economy and capacity to stimulate initiatives and incentives to promote the adaptation and mitigation plans and strategies to climate change (zero emissions, renewable energy development…), and it provides capacity to invest money in training and creating environmental awareness on climate change impacts.

Social factors in Trentino are influenced by the population, the tourism seasonality, its evolution and the equality aspects. The population has increased slightly in recent years, reaching 542,050 in 2023 (1st of January), which represents an increase of 0.2% compared to 2022; although the general trend in the recent years was of depopulation. Its distribution between men and women is equitable (50%). This little growth is due to migration rates that cause population fluctuations to be conditioned by the population demand required in the winter tourism sector, as well as a repopulation of mountain regions due to the temperatures increase. Over 45% of the population in the region is a foreign population. For the region, the Gini coefficient it is over 0.28, which gives an idea that incomes are not very different among the population. However, it is a value closer to the Netherlands one (0.26) than the Italy one (0.32), so the region is closer in some aspects to central Europe countries. Local associations and local authorities that enable training campaigns to improve the population's awareness of the reality of climate change guide the promotion of actions in the region.

Technological factors consider the role of technology as a driver to guide adaptation and mitigation against climate change. Trentino has one university and several research institutes that guide the research, development and innovation activities in the region. With great interest in sustainability, water and energy management and climate services. Its activities train the population to become aware of the use of resources and the sustainable models of hospitality-facilities services, which is the sector on which much of its economic activity depends. Fruit and wine production generate more than the 50% of the gross marketable production of the province[47], and since Trentino main challenges derive from its geographical situation (all the territory it is mountainous), the agricultural sector will receive the main amount of more than 300 Million € of the Rural Development Programmer budget.

Regarding **environmental factors**, there are initiatives at different scales to manage water and face extreme events. Several projects implemented in the region that seek to improve its sustainability or even, its adaptation to climate change are also a sign of the social and authorities' awareness, with great interest and commitment of regional and local administrations in following the guidelines established at the European level. Being a region dependent from snow tourism and water availability (scarcity due to climate change), the commitment to sustainable development is essential as a mean to ensure the survival of the ecosystem services of its territory and to avoid the loss and degradation of vulnerable areas such as the UNESCO Biosphere Reserve or the improvement in the use or resources as the water.

Finally, **legal factors** must be analysed, they are directly related to the legislative framework and regulations to improve the adaptation, hazards maps or use of resources. Initiatives to protect both the environment and energy, or the protected areas must be highlighted. Above all, the relevance of adaptation and mitigation strategies must be considered, which are key to ensure the region's climate neutrality and its resilience.

[47] https://ec.europa.eu/enrd/sites/default/files/it_trento_rdp_qnt_summary_v1.pdf

4.3. Summary of case study characterization in Trentino

Trentino is located in the north-east of Italy, and it is an entirely mountain territory with rich and unique environments. According to the climate and weather analysis under historical conditions and the projection to future period, the mean annual daily temperature will increase more than 5ºC in the most unfavourable scenario, being more than 10ºC by 2100. With respect to the evolution of precipitation, the future shows a slightly increasing trend, being the mean annual daily cumulated precipitation forecasted to raise up to 4.90% in the most unfavourable scenario. The maximum annual daily cumulated precipitation is expected to increase as well, which represents more torrential events.

The tourism and related activities are the mainstay of the local economy, and at the same time interdependent with other key economic sectors in the region as the agriculture, ecosystem services, trade and hydro-power production. Thus, the Case Study leader and supporter, and together with the local stakeholders, define as the Trentino most vulnerable sectors both the energy and tourism, as well as water and biodiversity in a second priority level.

Energy is a key sector for the Trentino economy, as it has an important share of renewable production. The main source of energy production is the hydroelectric (76%), which sees large concessions in the hands of energy producers and sellers. In fact, the electricity production exceeds the consumption. However, for the energy consumption, the Province of Trento imports about 65% of the energy used, from unavailable sources such as natural gas (mainly for the industrial sector) and oil products (for almost all transport needs). With a view on the tourism sector energy demand, the winder ski industry deeply relies on specific weather and natural conditions, and ski resorts are also characterised by a high energy consumption.

Tourism is another great economic sector in Trentino, whose relevance comes from the number of certified facilities and workers involved. It is largely affected by a marked seasonality of the tourism phenomenon, and lately improvement in performance in the other seasons as well. The tourism offer in Trentino is mainly related to ski and to enjoy the snowy and pleasant mountain temperatures in summer. In winter there is already the problem of the higher temperatures, that lead to a non-sufficient snow cover and shorten period of winter sports.

With respect to the relevance of the water sector, water resources are key asset for civil use, energy, agriculture, as well as touristic attraction and identity. In its link with the energy sector, the hydroelectric generation is a key use of the water, although it does not actually consume water (it is entirely returned downstream of the production installation). Derived from the decreasing of snow and its permanence on the ground, snowmaking is nowadays an essential activity for some ski resorts. Snow production is strictly linked to the availability of water used to refrigerate the systems when temperatures are above requirements.

Trentino also has a very extensive and articulate system of protected areas, with a 30% of its territory protected. This is why the biodiversity sector is also a relevant and vulnerable one as well. Mountain areas of Trentino are a biodiversity hotspot thanks to the geographical position, to the diversity of soils and the great variety of micro-environments. Alpine territories are among the areas at high risk of biodiversity loss, with climate change impacting the physiology, life cycle, disease resistance and geographical distribution of species, among others.

The adaptation and mitigation baseline have been analysed as well, where road transport and industrial combustion are the main CO_2 emitters in the region, following by combustion in buildings. The carbon stock in vegetation and soil can be highlighted, although the capacity for carbon stock in biomass has decreased in the recent years.

As per the past experiences in the Autonomous Province of Trento, a total of 27 documents were analysed at high-level, and ten out of them were further analysed due to their relevance, including the Italian National Plan for adaptation to climate change, the Italian National Integrated Plan for energy

and Climate, the Trentino Provincial Sustainable Development Strategy (Agenda 2030), the Environmental Energy Plan of the Trentino Province (2021-2030), and Water Quality Protection Plan (2022-2027), the Research and Innovation Strategy for Smart Specialisation 2021-2027 (of the Autonomous Province of Trento) among others.

In accordance with the Local Council of Stakeholders of Trentino case study, the drivers considered as enabling factors for climate change policies implementation were analysed through the aspects of a PESTLE analysis. Among them, the following can be outlined: the fact of being an Italian Autonomous Province (for governmental competences), land use plan for protected natural areas, local public incentives, private initialise and investments for energy and water sustainable solutions, technologies for renewable energy production, and the Water Management Plan published last year (2022).

5. Case Study 3 – Boreal region (Norrbotten County) characterisation

The county of Norrbotten [ˈnôrːˌbɔtːɛn] is Sweden's northernmost county (Figure 82) and is divided into 14 municipalities. It is the largest county with its 97,239 km^2, representing almost a quarter of Sweden's total area and can be compared to the size of Portugal or Austria. In the county you can find mountain areas in the north as well as a long coastline along the Bothnian Bay, where most of the county's 249,177 inhabitants live (Regionfakta 2023, Official statistics of Sweden). However, most of the total area, almost 60%, is forested (Statistics Sweden, 2023b).

In Norrbotten you can find the Sami - Europe's only indigenous people. Many of them live in Sápmi, the large land area that stretches across the northernmost parts of Sweden, Norway, Finland and Russian Kola Peninsula. The Sami, with their language, culture and business life and cross-border cooperation, are an important part of Norrbotten's history and future (Regional utvecklingsstrategi för Norrbotten). Reindeer herding is one of the primary livelihoods for Indigenous peoples throughout the Arctic. The Sami are now aware that the effects of increased pressures from alternative land use activities (such as mining or energy production) in the county challenge future reindeer herding. The non-predictable environmental conditions that come with a warming climate makes this sector even more vulnerable (Rosqvist, 2022).

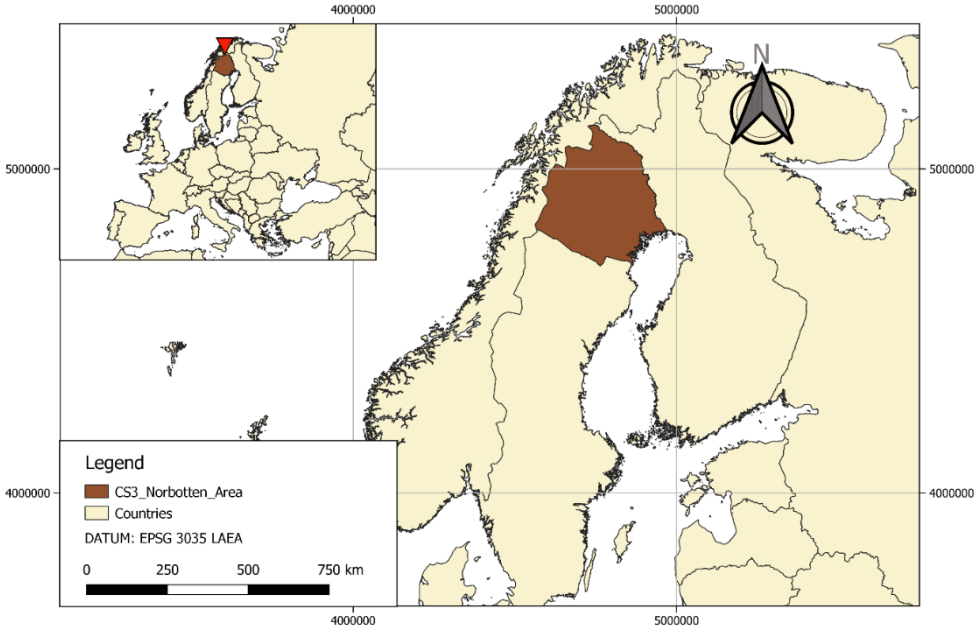


Figure 82. Location of CS3, Norrbotten Region.

The agricultural sector is not significant in the county. Of the total area only 1 per cent is arable land and this is dominated by milk and meat production as well as cultivation of potatoes and vegetables. A greater proportion of the arable land is used for sorghum cultivation in the county than in the country as a whole. (The Swedish board of Agriculture, 2015).

Norrbotten is rich in natural resources and is an industrially heavy county. This naturally affects emissions, electricity and heat production and energy use today. But Norrbotten is also a county where new innovations are born, and it is likely to affect emissions, electricity and heat production and energy use in the future (Energi- och klimatöversikt för Norrbottens län 2020).

Future investments in the county may fundamentally change the distribution between the different types of energy. Above all, it concerns investments in producing fossil-free iron and steel. Today, steel production in Luleå alone accounts for nearly 10% of Sweden's total CO_2 emissions. In today's system, coal is used. This will be replaced with hydrogen that is split from water via electrolysis (which

generates water vapor as emissions, instead of CO_2) (Energi- och klimatöversikt för Norrbottens län 2020).

The GRP (Gross Regional Product) is the cumulative value of all goods and services produced in a region in one year. The GRP shows how great the production is in SEK. Norrbotten has an index value of 140 (2020), which means that the value for the region is 40% higher than the value for Sweden (Figure 83) (Regionfakta 2023).

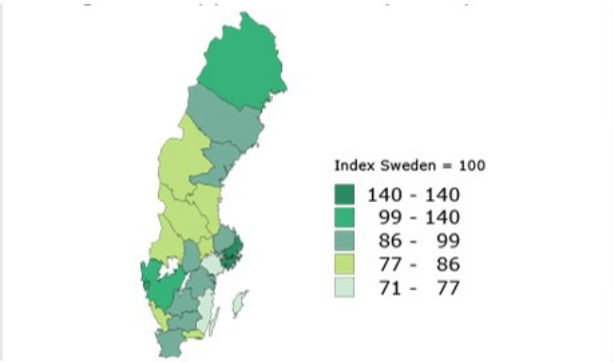


Figure 83. Regional GDP per inhabitant by county in Sweden in 2020. Source: Regional GDP - Regionfakta

It is estimated that within the next ten years, several thousand new jobs will be created in Norrbotten. Not only high-tech jobs connected to the industrial development but also in healthcare, education and administration as public service also will need to be reinforced to accommodate the new citizens (Lotta Finstorp, Norrbotten County Governor).

5.1. Analysis of geographical landscape and historical climate conditions

This section includes an analysis of the historical and future climate in the Region of Norbotten and also of the main sectors that will be affected by forecast changes in the climate due to the increase of emissions and the associated effects in social, economic and environmental systems.

5.1.1. Climate analysis and characterisation of vulnerable sectors

In this section, two relevant objectives are covered: (i) an assessment of the main climate data (temperature, precipitation and wind) in the historical (1985-2015) and future period (from 2023 to 2100) under two different climate scenarios for the Norbotten Region and (ii) identification and description of the main assets per vulnerable sector that will be affected by future changes in the climate.

5.1.1.1. Climate and weather analysis

Climate analysis is based on the Essential Climate Variable (ECVs). More in detail, the following variables are evaluated: maximum annual daily cumulated precipitation, mean annual daily cumulated precipitation, mean annual daily maximum temperature, mean annual daily minimum temperature, mean annual daily mean temperature and mean annual daily mean surface wind speed.

- **Temperature**

If we analyse the obtained results of climate models in the future for temperature, we identified that the mean annual daily temperature in the Norrbotten Region (1.27ºC in the historical period) will increase according to the two considered climate scenarios. It is expected that the mean annual daily temperature increases in more than 5.7ºC in the most unfavorable scenario (SSP585) in the long term. In this sense, the temperature will increase more than 7ºC by 2100. Considering the minimum and

maximum mean annual daily temperature, the same pattern is expected facing a warmer climate with very high temperature in extremes. Table 30 presents the temperature results in the Norrbotten Region for two different scenarios (SSP245 and SSP585) and the comparison with the mean values in the historical.

Table 30. Mean, Maximum and Minimum temperature and related anomalies comparing with the historical. Lighter red colour implies smaller changes while dark red implies higher changes.

Scenario and period		Mean temperature	Mean maximum temperature	Mean minimum temperature
Historical scenario		1.27	3.78	-2.16
SSP245 scenario	**2023-2039**	2.47	4.90	-0.90
	2040-2069	3.45	5.94	0.26
	2070-2100	4.47	7.02	1.42
SSP585 scenario	**2023-2039**	2.75	5.12	-0.67
	2040-2069	4.16	6.62	0.99
	2070-2100	7.02	9.53	4.09
Anomaly SSP245 scenario	**2023-2039**	1.21 ↑	1.14 ↑	1.26 ↑
	2040-2069	2.19 ↑	2.18 ↑	2.42 ↑
	2070-2100	3.20 ↑	3.26 ↑	3.58 ↑
Anomaly SSP585 scenario	**2023-2039**	1.48 ↑	1.36 ↑	1.49 ↑
	2040-2069	2.89 ↑	2.86 ↑	3.15 ↑
	2070-2100	5.76 ↑	5.78 ↑	6.25 ↑

Figure 84 presents the results of the evolution of mean annual daily temperature along the period 2015-2100 using downscaled data from eight different climate models for the SSP245 climate scenario. The average value for the eight models under SSP245 is presented in Figure 85 where the confidence interval is represented by the maximum and minimum value of the set of models in each simulation year. The same representation for the temperature variation under SSP585 climate scenario is included in Figure 86 and Figure 87 respectively. Results show a high heterogeneity between model results and scenario with a growing trend along the evaluated period in both cases, being higher the temperature increase in the most extreme scenario (SSP585).

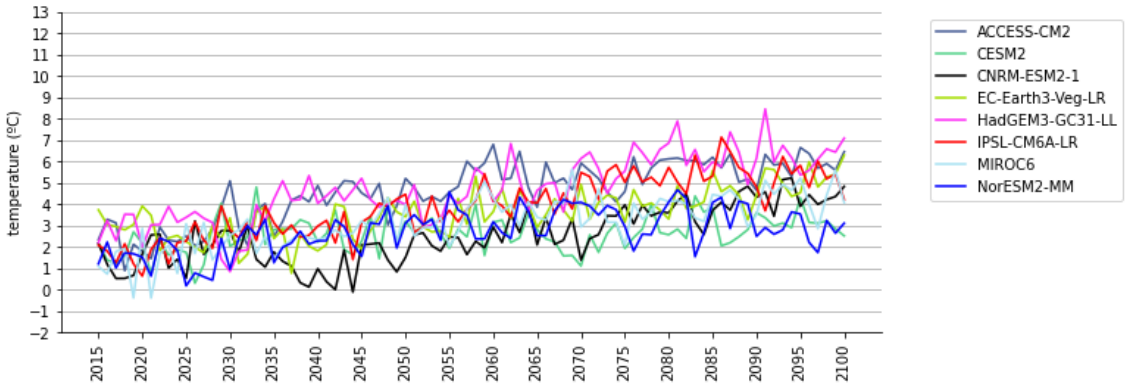


Figure 84. Mean annual daily temperature in the SSP245 scenario (2015-2100) for eight models in the region of Norrbotten obtained by statistical downscaling procedure.

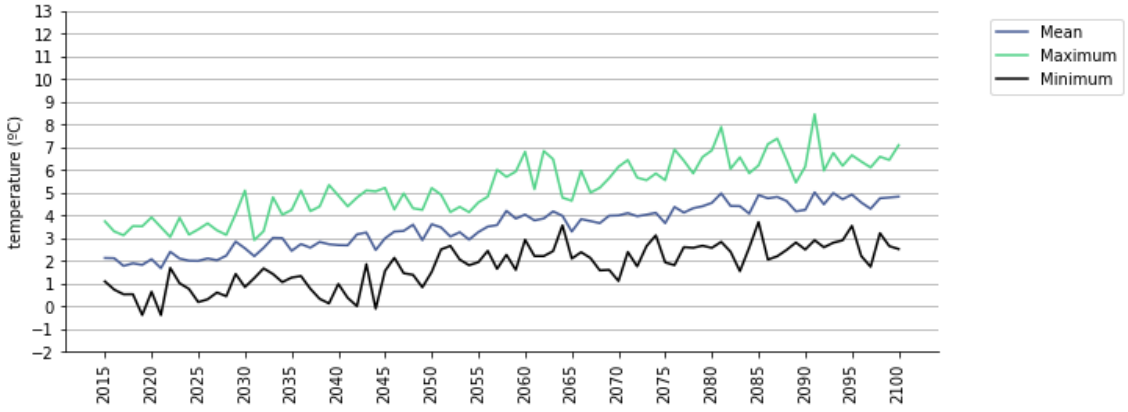


Figure 85. Ensemble mean annual daily temperate and range of variation (Maximum and Minimum) for a set of eight models in the SSP245 scenario (2015-2100) for the region of Norrbotten.

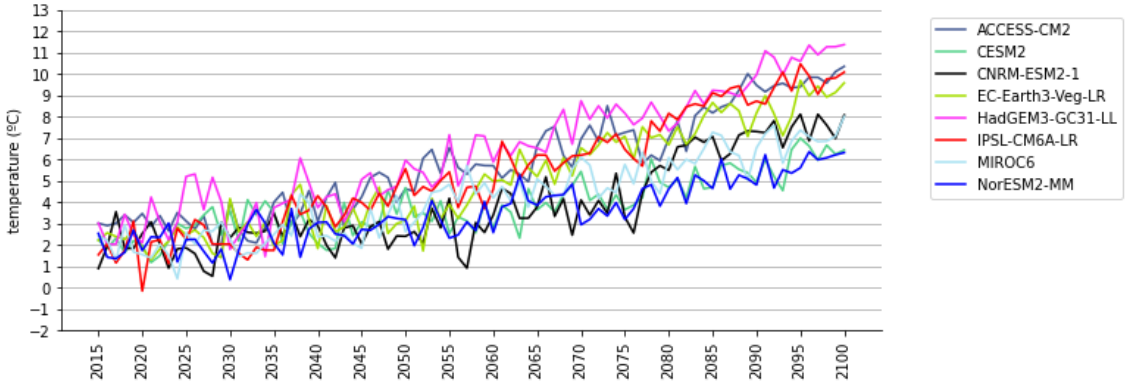


Figure 86. Mean annual daily temperature in the SSP585 scenario (2015-2100) for eight models in the region of Norrbotten obtained by statistical downscaling procedure.

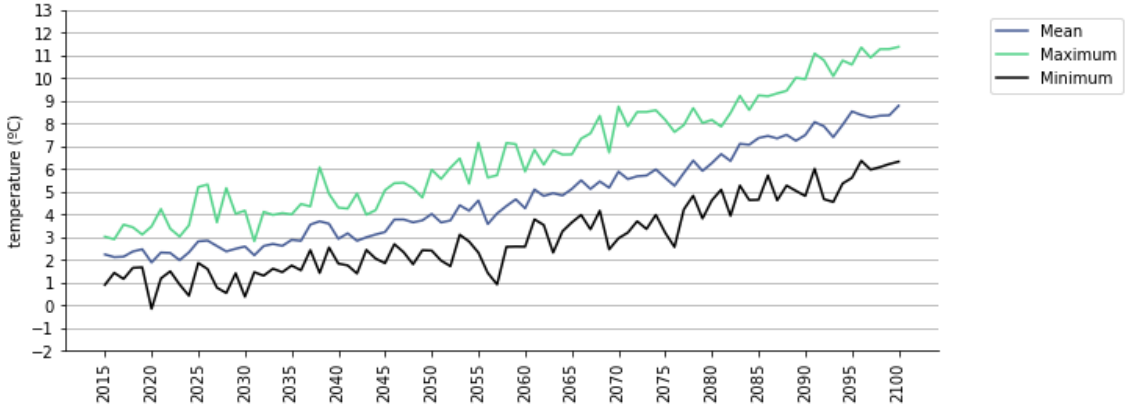


Figure 87. Ensemble mean daily annual temperate and range of variation (Maximum and Minimum) for a set of eight models in the SSP585 scenario (2015-2100) for the region of Norrbotten.

○ Precipitation

The evolution of precipitation in the future shows a slightly increasing trend. Considering its evolution throughout the time periods analyzed (Table 31), the increase in precipitation will be more visible in the most unfavorable scenario (SSP585). The mean annual daily cumulated precipitation observed in the historical period is 2.62 mm/day, which is equivalent to an annual precipitation of 956.3 mm. The results of the models for the future, forecast an increment in precipitation of up to 21.76% in the most unfavorable scenario. This increase implies to have an average of 208.05 mm more of precipitation per

year, which can cause a benefit of water resources at regional level in the long term. On the other hand, the maximum annual daily cumulated precipitation increases in all evaluated periods except in the long term in the most unfavorable scenario where there is more uncertainty. This puts us in front of a scenario of more torrential events in the Region of Norrbotten.

Table 31. Mean and Maximum annual daily cumulated precipitation and related anomalies comparing with the historical. Lighter blue colour implies smaller changes while dark blue implies higher changes.

Scenario and period		Mean annual daily cumulated	Maximum annual daily cumulated
Historical scenario		2.62	33.42
SSP245 scenario	**2023-2039**	2.71	35.70
	2040-2069	2.83	37.07
	2070-2100	2.92	38.26
SSP585 scenario	**2023-2039**	2.79	36.59
	2040-2069	2.91	37.83
	2070-2100	3.19	40.71
Anomaly SSP245 scenario	**2023-2039**	0.09 ↑	2.28 ↑
	2040-2069	0.21 ↑	3.65 ↑
	2070-2100	0.31 ↑	4.83 ↑
Anomaly SSP585 scenario	**2023-2039**	0.17 ↑	3.17 ↑
	2040-2069	0.29 ↑	4.41 ↑
	2070-2100	0.57 ↑	7.29 ↑

Figure 88 presents the results of the evolution of the mean annual daily cumulated precipitation along the period 2015-2100 using downscaled data from eight different climate models for the SSP245 climate scenario. The average value for the eight models under SSP245 is presented in Figure 89 where the confidence interval is represented by the maximum and minimum value of the set of models in each simulation year. The same representation for the mean annual daily cumulated precipitation variation under SSP585 climate scenario is included in Figure 90 and Figure 91 respectively. The results by model have great heterogeneity, which is very visible in the figures for comparing the results of the models, where no clear trend is observed by model evaluating the precipitation results.

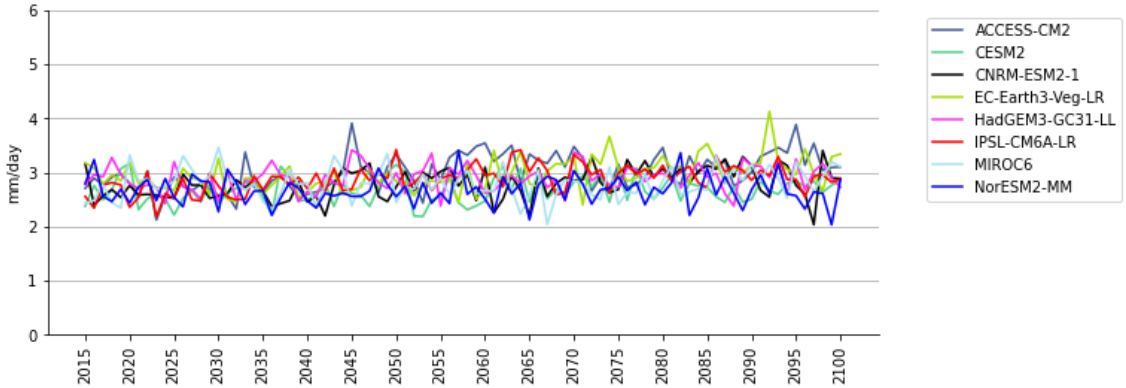


Figure 88. Mean annual daily cumulated precipitation in the SSP245 scenario (2015-2100) for eight models in the region of Norrbotten obtained by statistical downscaling procedure.

Figure 89. Ensemble mean annual daily cumulated precipitation and range of variation (Maximum and Minimum) for a set of eight models in the SSP245 scenario (2015-2100) for the region of Norrbotten.

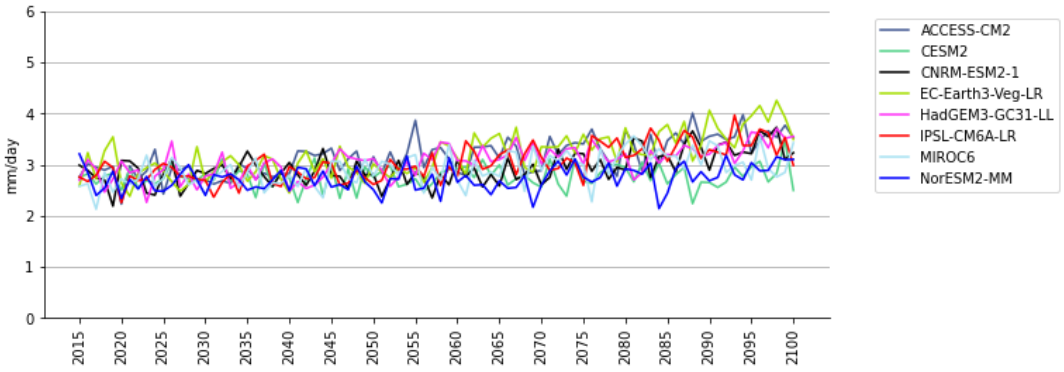


Figure 90. Mean annual daily cumulated precipitation in the SSP585 scenario (2015-2100) for eight models in the region of Norrbotten obtained by statistical downscaling procedure.

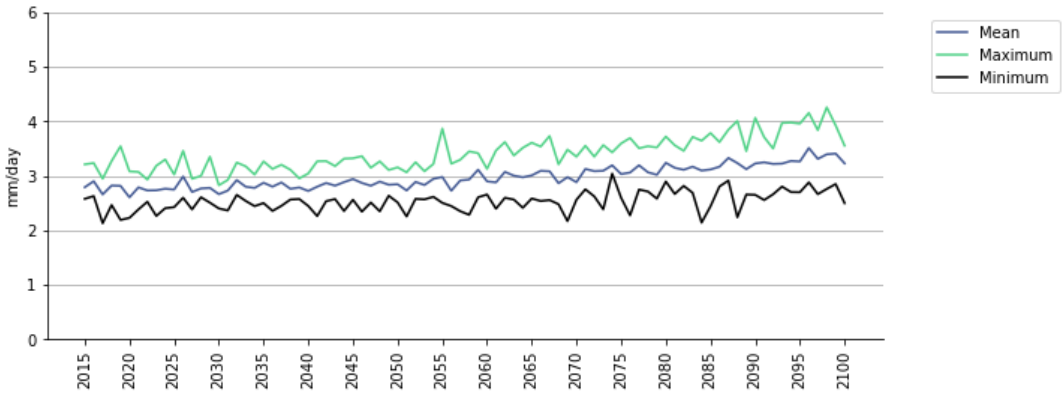


Figure 91. Ensemble mean annual daily cumulated precipitation and range of variation (Maximum and Minimum) for a set of eight models in the SSP585 scenario (2015-2100) for the region of Norrbotten.

○ Wind

Analyzing the results of the two selected climate scenarios for the future to investigate the evolution of the mean annual daily wind speed in the Region of Norrbotten, a trend is observed that projects a small decrease in the average wind speed if we compare it with respect to the average value of the historical scenario (Table 32). These changes in wind speed are conditioned by the increase in temperatures, together with a driest climate and a decrease of vegetation cover. However, and despite the forecast decrease, the average value will not fall below 3.3 m/s even in the most unfavorable scenario (SSP585).

Table 32. Mean annual daily surface wind speed and related anomalies comparing with the historical. Lighter grey colour implies smaller changes while dark grey implies higher changes.

Scenario and period		Mean annual daily surface wind speed
Historical scenario		3.46
SSP245 scenario	2023-2039	3.42
	2040-2069	3.39
	2070-2100	3.35
SSP585 scenario	2023-2039	3.40
	2040-2069	3.39
	2070-2100	3.33
Anomaly SSP245 scenario	2023-2039	-0.05
	2040-2069	-0.07
	2070-2100	-0.12
Anomaly SSP585 scenario	2023-2039	-0.06
	2040-2069	-0.07
	2070-2100	-0.13

Figure 92 presents the results of the evolution of the mean daily wind speed along the period 2015-2100 using downscaled data from six different climate models for the SSP245 climate scenario. The average value for the six models under SSP245 is presented in Figure 93 where the confidence interval is represented by the maximum and minimum value of the set of models in each simulation year. The same representation for the mean annual daily wind speed variation under SSP585 climate scenario is included in Figure 94 and Figure 95 respectively. The results by model have great heterogeneity where more or less a constant trend is observed when evaluating the wind results.

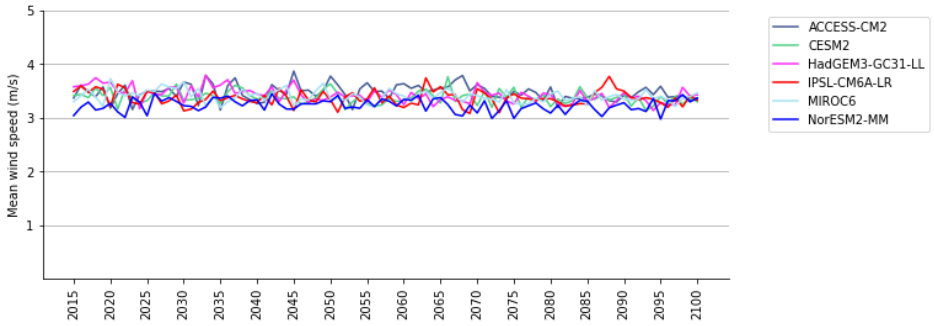


Figure 92. Mean annual daily wind speed in the SSP245 scenario (2015-2100) for six models in the region of Norrbotten obtained by statistical downscaling procedure.

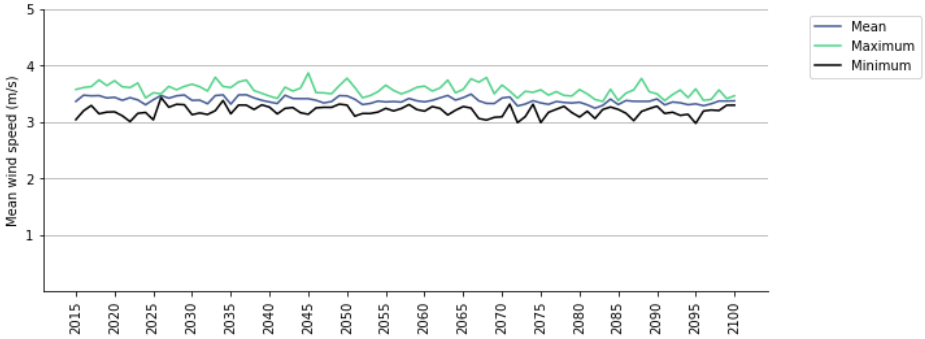


Figure 93. Ensemble mean annual daily wind speed and range of variation (Maximum and Minimum) for a set of six models in the SSP245 scenario (2015-2100) for the region of Norrbotten.

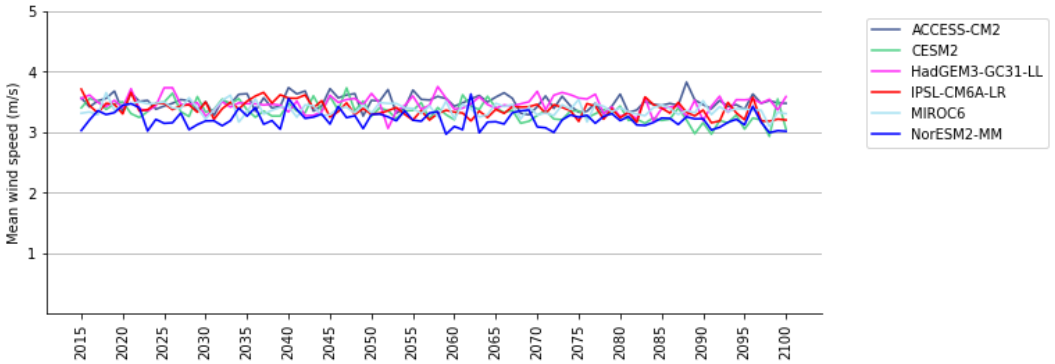


Figure 94. Mean annual daily wind speed in the SSP585 scenario (2015-2100) for six models in the region of Norrbotten obtained by statistical downscaling procedure.

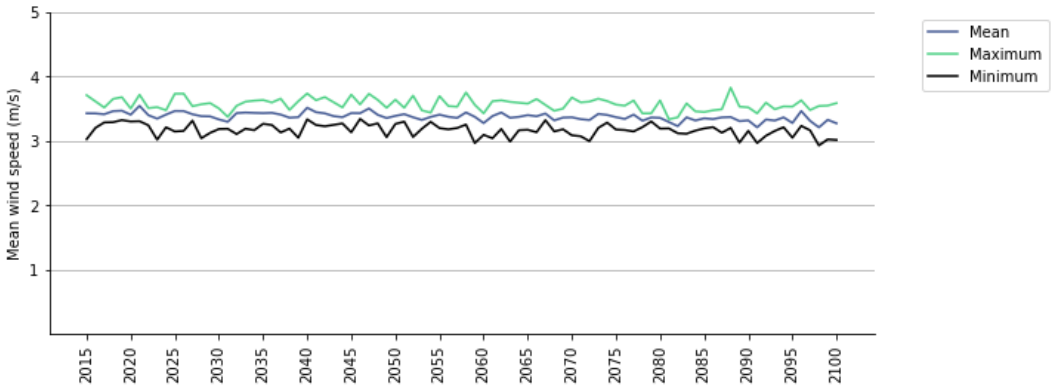


Figure 95. Ensemble mean annual daily wind speed and range of variation (Maximum and Minimum) for a set of six models in the SSP585 scenario (2015-2100) for the region of Norrbotten.

5.1.1.2. Vulnerable sectors: identification of exposure assets

As introduced in section 2.1.1.2, the key vulnerable NEVERMORE sectors for Norrbotten case study are agriculture, forest and fishing (with a focus on reindeer husbandry), tourism, leisure and cultural heritage, as well as biodiversity and natural heritage for the high priority sectors, and with a lower level priority the sectors of mining and quarrying and energy. This was agreed with case study leaders in the first consultation (internal) as contrast exercise with the challenges and vulnerable sectors identified at the proposal stage. The activity consisted of an online Jamboard in which the CS leaders identified their main challenges, to then relate them with the sectors and priorities for them (Figure 96).

Then, the first consultation with the Local Council of Stakeholders was held, and a similar activity to confirm the selection and hear other voices on this was performed. During this activity (developed the 22nd February 2023 in an in-person workshop) the stakeholders overall recognized and agreed with the challenges previously identified. Regarding the reindeer husbandry, there was a comment about being culture-bearing and therefore vulnerable in many perspectives. Reindeer husbandry is protected by laws (minority law, convention on biological diversity) but they are not enforced. It was also discussed that the region relies on being able to import products (food, construction material, IT equipment, etc.), and therefore also share the challenges that exist in other countries they buy products from, as per the dependence. Challenges connected to infrastructures (roads, buildings, infrastructure connected to drinking/sewage water) were also discussed.

Additionally, it was highlighted that it is not well known in Norrbotten that they also must work with climate adaptation. As they don't have a direct thread of floods or droughts in general in the country right now in comparison with other parts of Sweden, which can make it difficult for citizens to realise and see that adaptation is still needed.

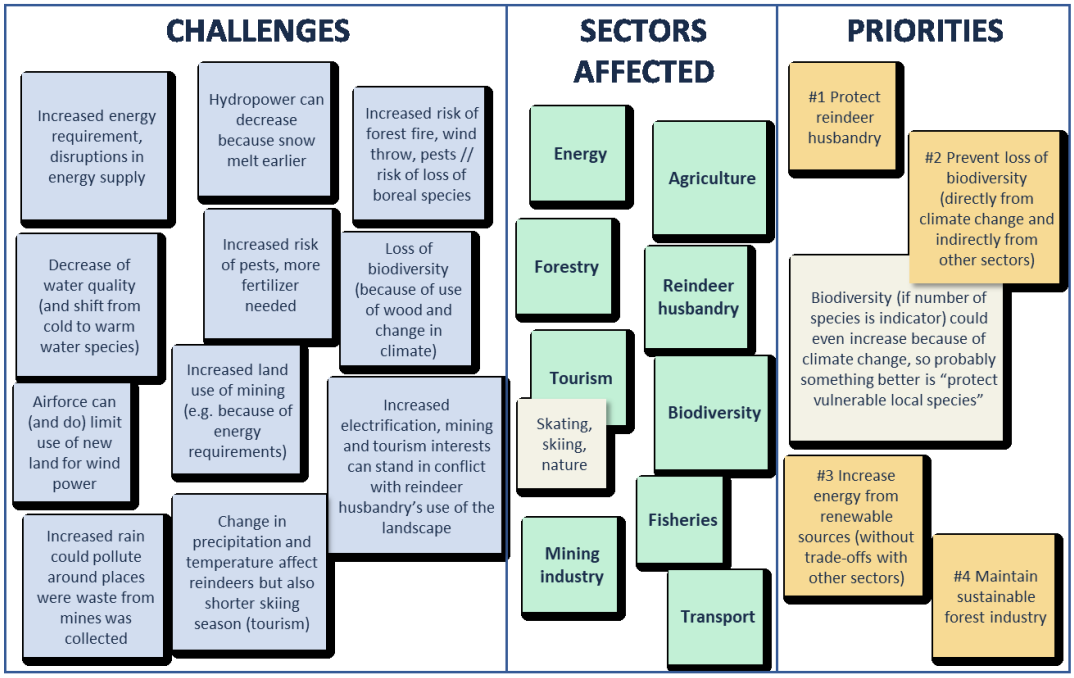


Figure 96. Results of the consultation with case study leaders on the CS challenges, related sectors affected and priorities

○ Agriculture, forestry and fishing

In the CS of Norrbotten, the focus is on forestry, reindeer husbandry, and then in agriculture, livestock other than reindeer, and fishing.

▪ FORESTRY

40% of Norrbotten County is covered by productive forest, with most of the other 60% being high mountains, mires and subalpine woodland (Figure 97) (Swedish Forestry Agency, 2014[48]; Statistics Sweden, 2023[49]). The forestry sector is very important for the region. The climate is cold, and trees grow slowly and gets a dense wood that is considered of high quality for the species. There is a climatic gradient in Norrbotten County from the warmer eastern coastal area to the colder mountains in the western part, with an accompanying gradient in productivity of the forest.

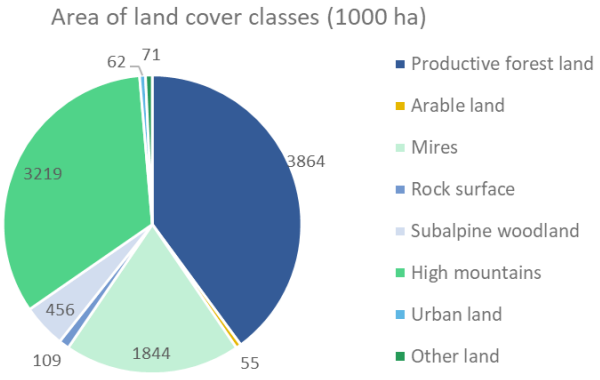


Figure 97. Land cover of Norrbotten County (2014)

[48] https://www.scb.se/hitta-statistik/statistik-efter-amne/jord-och-skogsbruk-fiske/amnesovergripande-statistik/skogsstatistisk-arsbok/
[49] https://www.scb.se/hitta-statistik/statistik-efter-amne/jord-och-skogsbruk-fiske/

The area of productive forest has stayed approximately the same since 1951 (Figure 98). Unproductive forest area has decreased since 2000, when the category was introduced in the statistics.

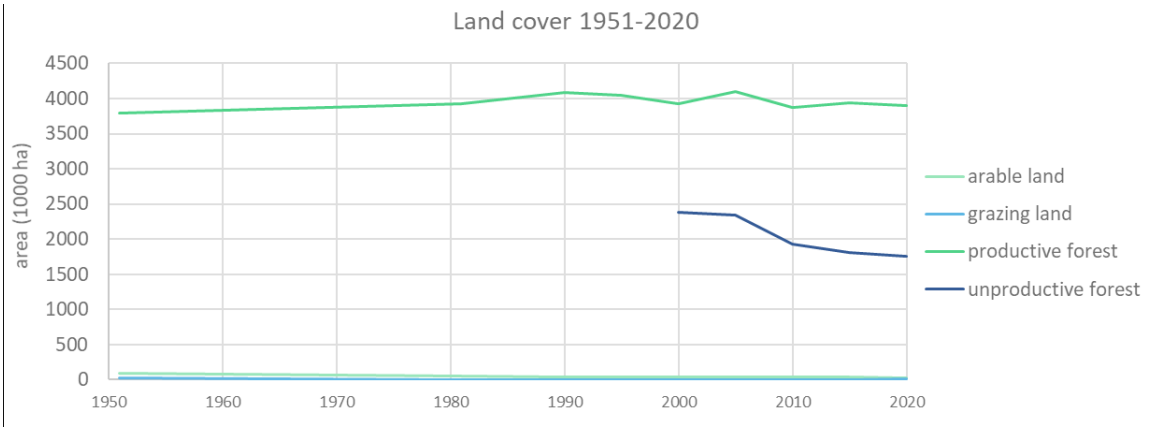


Figure 98. Changes in land cover in Norrbotten County for four land cover classes: arable land, grazing land, productive and unproductive forest

The forest harvesting method is mainly clear-cutting, after which new forest stands are established by planting, seeding or leaving a number of mature trees for seeds. As this method has been in use in the county since late 19th century, around 90% of the productive forest has been clear-cut at some point in time, and the forest ages for these forests are varying from newly established to 140 years old (Figure 99), with the most common age groups being around 30-70 years (21-60 in 2014 as in the Figure 99). Norrbotten County has the largest amount of old forest in Sweden, with 29% of all Swedish old forest, where old forest is defined as older than 140 years in the boreal zone, and older than 120 years in the boreonemoral and nemoral zones further south in Sweden (SLU, 2023). About half of the old forest in Norrbotten County is in protected areas, and much of it is in the mountains in the western part of the county.

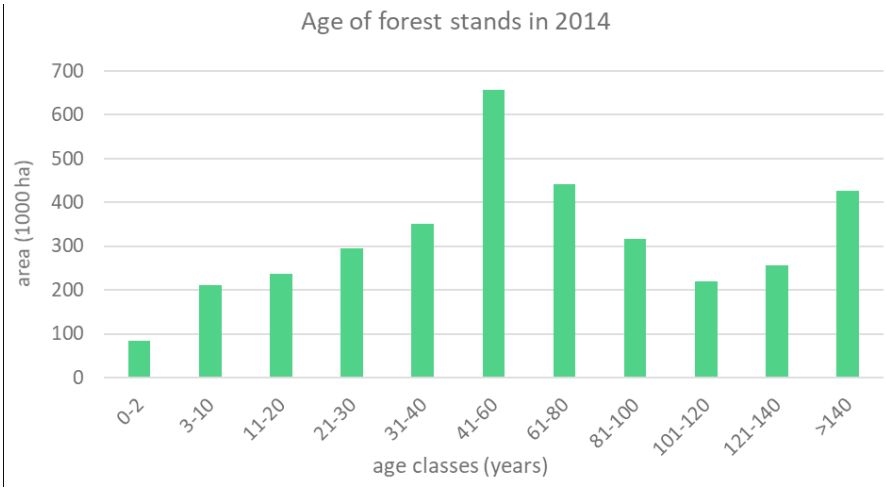


Figure 99. Stand ages for productive forest in Norrbotten County in 2014

The lowest allowed harvesting age in Norrbotten County is 80 years for the most productive forest class present in Norrbotten County in more than very small areas, up to 100 years for the forest in the least productive land class of the productive forest lands. The limit between unproductive forest and productive forest is placed at a forest growth of 1 m^3 standing volume per hectare and year (m^3/ha/yr), and in Norrbotten County, the growth in the productive forest normally falls between 1 and 5 m^3/ha/yr (Figure 100), with an average growth for productive forest around 3 m^3/ha/yr and for all forest around 2 m^3/ha/yr. This is low compared to Sweden as a whole, with an average of 5 m^3/ha/yr and where 10 m^3/ha/yr and above is occurring.

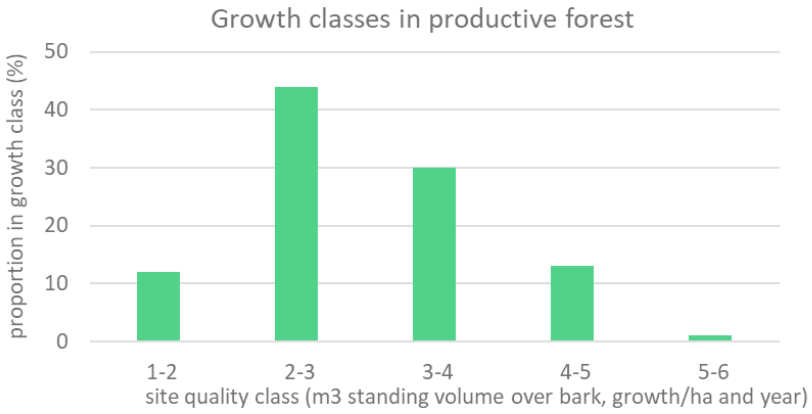


Figure 100. Forest growth rate classes in productive forest in Norrbotten County

The forest in Norrbotten is species poor when it comes to tree species, due to the recurring glacials and the geographic situation, that have periodically erased all biota and hindered the migration back during interglacials. The most common tree species are Scots pine, Norway spruce and birch (Figure 101). Aspen, larch, alder, salix species and mountain ash are also occurring, as well as planted Lodgepole pine (Pinus contorta) on 2.5% of the productive forest area. Lodgepole pine is a species introduced from North America.

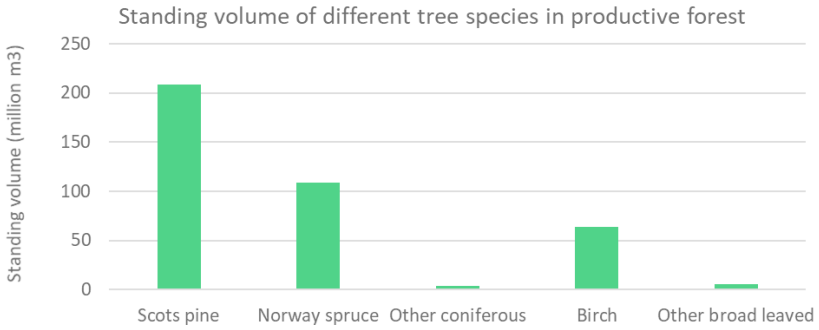


Figure 101. Species, by standing volume of wood, in productive forest in Norrbotten County

Harvest volumes in Norrbotten County have varied around 5 million m^3 standing volume since 1995 (Figure 102), which is a bit less than half of the annual growth of 11.4 million m^3 standing volume. On 5,500 ha of the annual harvested area of around 20,000 ha, 0.4 million m^3 branches and tops are extracted for use as biofuels.

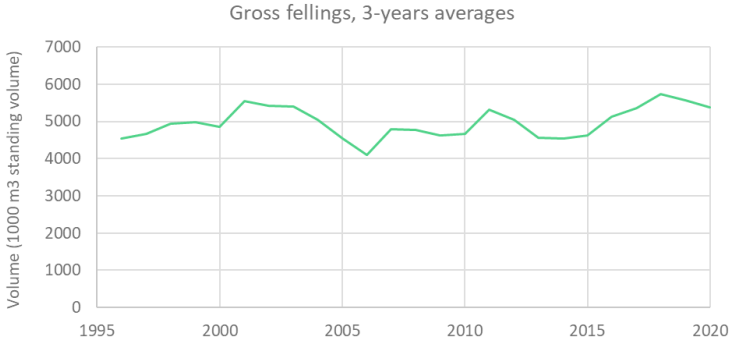


Figure 102. Volume of forest harvest in Norrbotten County, 1995-2020

There are large saw mills and paper mills in Norrbotten County, processing the harvest. The forestry and the related wood and paper industry employ around 6,000 people in Norrbotten County (Figure 103).

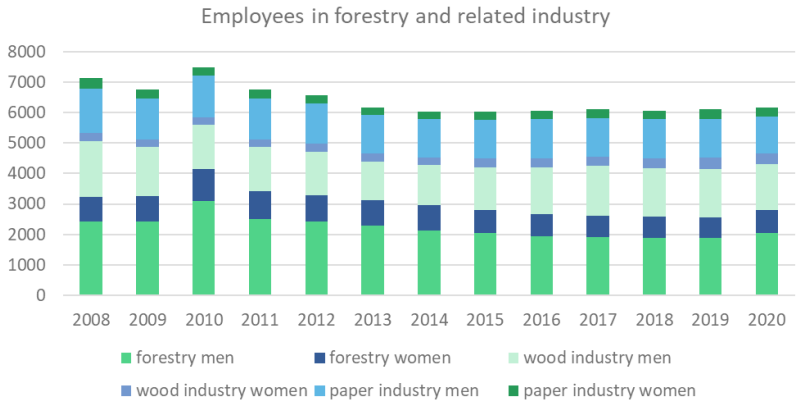


Figure 103. Number of employees in forestry and in wood and paper industry in Norrbotten County

There are around 25000 forest owners in Norrbotten County, with the Swedish state (47%), private owners (34%), private companies and the church represented. There is also a large berry production in the forests in northern Sweden, with professional berry picking generating thousands of tons of berries for the food industry.

▪ REINDEER HUSBANDRY

Parts of the Sami population in Norrbotten County are reindeer herders, which is one of their traditional and important economic sectors. All reindeer in Sweden are domesticated. They graze in forests and on the mountains and travel between summer grazing lands and winter grazing lands, using partly the same areas used for forestry. The reindeer herders have legal right to let the reindeer graze on lands regardless of current land ownership, but at the same time, owners of productive forestry land have the right, and even obligation, to conduct forestry in a way that utilises the wood growth potential. This has, and does still, usually meant clear-cutting grown forests and replanting the areas with same age, same species stands, and is therefore clashing with the grazing needs of the reindeer. The area of old forest with lichens, suitable for reindeer, has been decreasing with 78% in Norrbotten County between 1950 and 2015 (Horstkotte & Djupström, 2020). The reindeer herding is organised through 51 Sami communities, which are geographic areas (sometimes overlapping) of cooperating reindeer owners. In Norrbotten County there are 32 Sami communities (Sámediggi, 2023) (Figure 104), organising almost 4,000 reindeer owners, owning a number of reindeers varying from 121,000 (in 2001) to 162,000 (in 2005). Around 800 people are responsible for a reindeer herd (own and other owner's reindeer) (Figure 105).

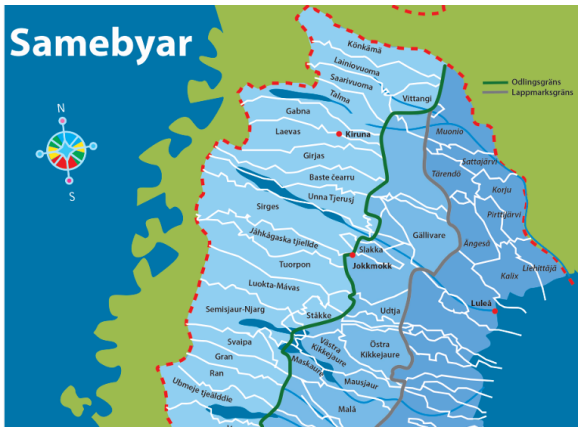


Figure 104. Map of Sámi communities in Norrbotten County, from the Sámi parliament, Sámediggi[50]

[50] https://www.sametinget.se/8382

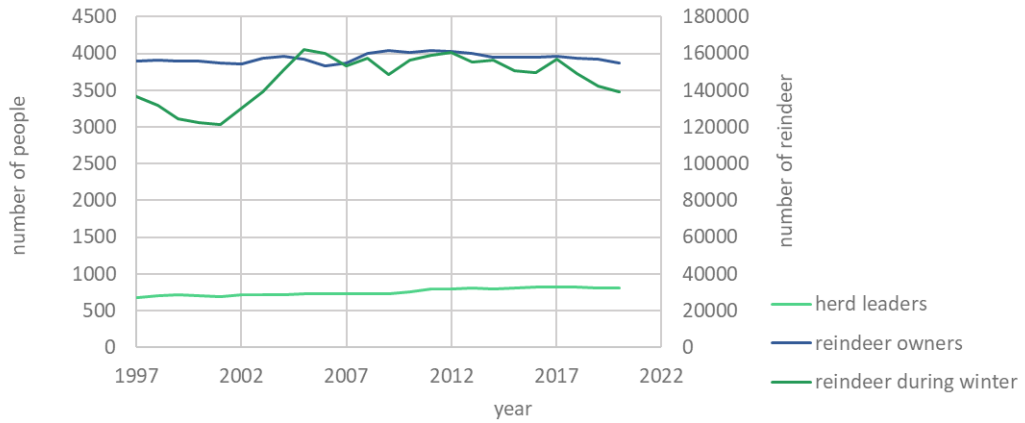


Figure 105. Number of reindeer in Norrbotten County during the winters (on the right y-axis), reindeer owners and people working as responsible for reindeer herds

The yearly economic value of the reindeer meat and other products are around 3.6 million € per year, or 4.2 million € per year with subsidies, during the last ten years (Figure 106). The Chernobyl accident in 1986 led to deposition of radioactive caesium in the north of Sweden, but south of Norrbotten County. In the affected areas, bio-accumulation- of radioactive isotopes led to vegetation and many animals becoming unsuitable for human consumption and this affected the value of reindeer also in Norrbotten County for at least two decades afterwards, despite low radioactive deposition in Norrbotten County itself.

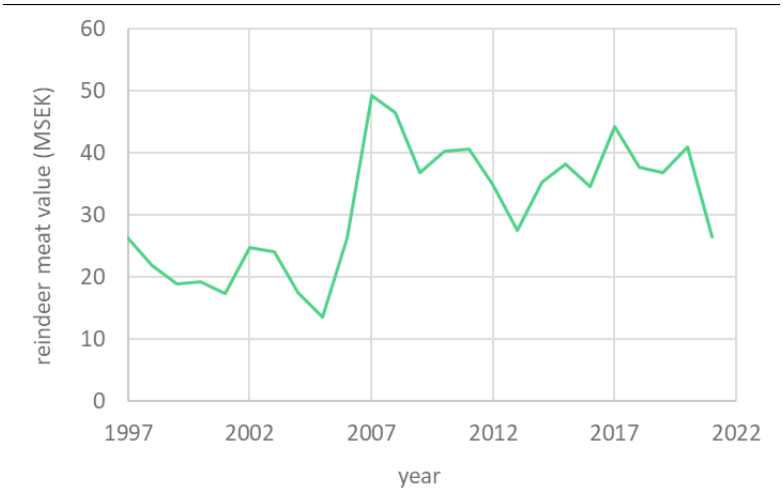


Figure 106. Value of reindeer slaughter in Norrbotten County, 1997-2021, in million Swedish kronor

AGRICULTURE

Agriculture in Norrbotten County, except the reindeer herding, is mainly located along the coast and along the river valleys, and dominated by milk and meat production. A greater proportion of the arable land is used for grassland cultivation compared with the rest of Sweden.

Farmers in Norrbotten receive additional agricultural support to compensate for the limitations that the climate entails. Nevertheless, many farmers find it difficult to survive financially and there is a lack of young people who want to continue to run the farms.

In Norrbotten, only about 0.3% of the land area is agricultural land (31,824 ha of arable land and 10,440 ha pasture land in 2022 (Swedish Board of Agriculture, 2023). Arable land decreased by 22% between 1999 and 2022 (Figure 107 and Figure 108).

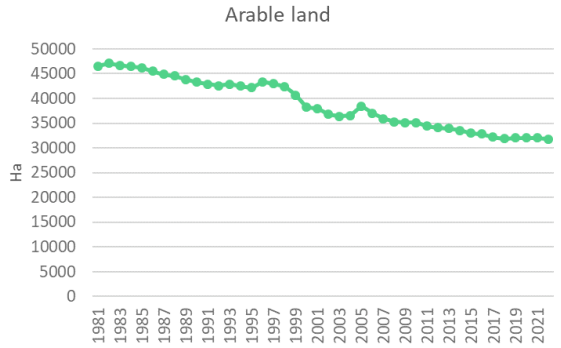


Figure 107. Arable land (hectares) in Norrbotten 1981-2022. Source: Swedish Board of Agriculture, 2023

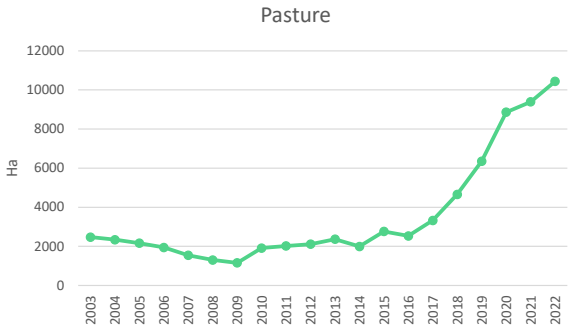


Figure 108. Pasture land (hectares) in Norrbotten 2003-2022. Source: Swedish Board of Agriculture, 2023

Due to a short growing season, it is challenging to produce many crops such as grains and legumes. However, conditions for grass growth are good, with plenty of water and many hours of light during the summer months. In Norrbotten County, most of the arable land (about 78%) is therefore used as cultivated grassland, fodder and green fodder plants (Figure 109 and Figure 110). Cereals are cultivated on 11% of the arable land, and spring barley is the dominant cereal (more than 80%), see Figure 111. About 7% of the arable land in Norrbotten County is fallow land. The remaining 3% of the arable land is used for other crops, mainly potatoes, oilseed crops, peas and beans.

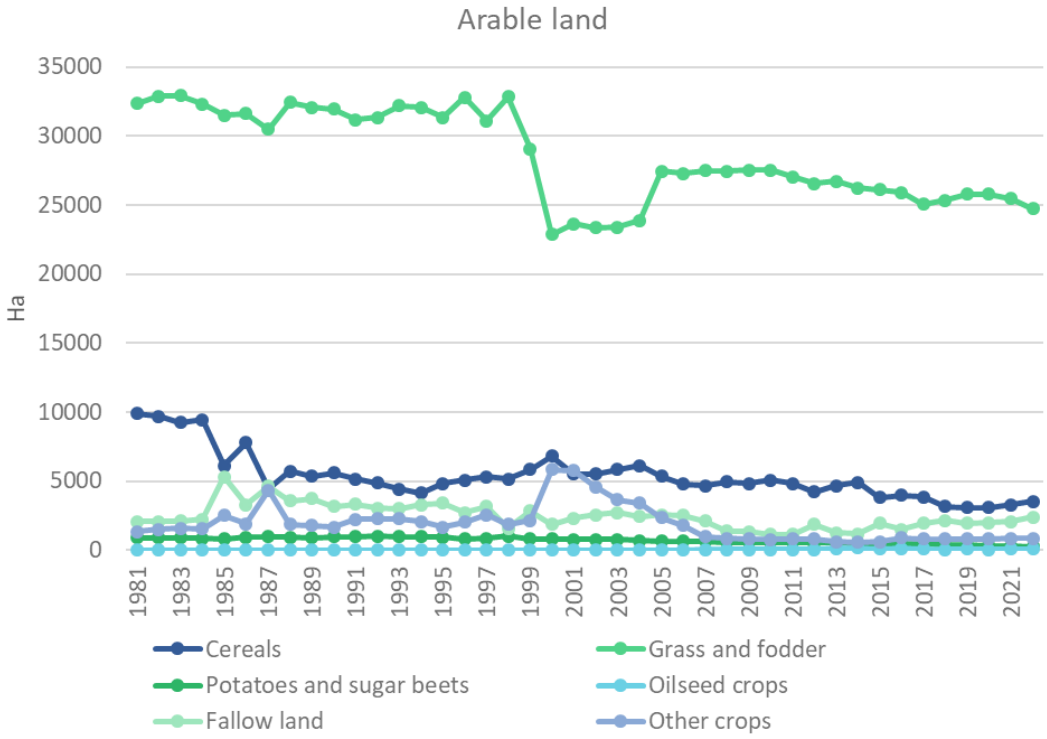


Figure 109. Arable land in Norrbotten 1981-2022. Source: Swedish Board of Agriculture, 2023

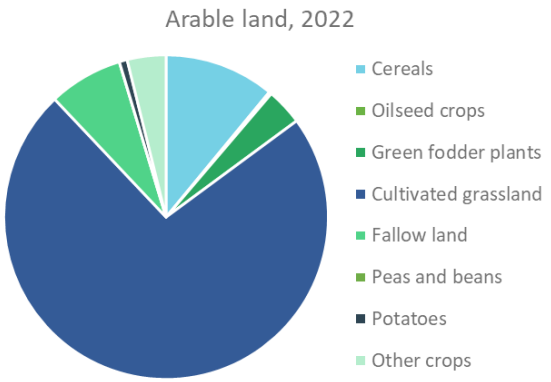


Figure 110. Arable land in Norrbotten, 2022. Source: Swedish Board of Agriculture, 2023

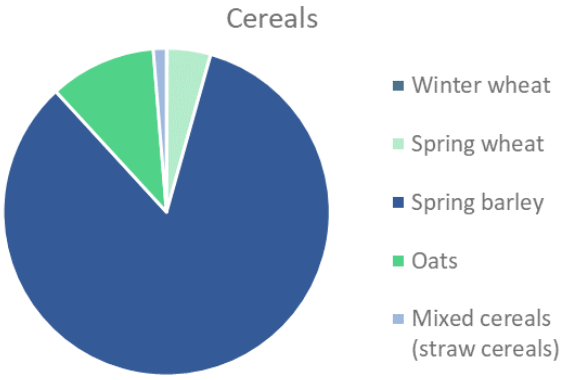


Figure 111. Spring barley is the dominant cereal in Norrbotten (data for 2022). Source: Swedish Board of Agriculture, 2023

The number of ha of arable land used for cereal cultivation decreased by 40% between 1999 and 2022 (Figure 109). During the same time period, the total arable land in Norrbotten decreased by 22%. In 1999, 14% of the total arable land was used for cereal cultivation, but in 2022, the corresponding share was just 11%.

In Norrbotten, the area used for growing food potatoes decreased by 69% between 1999 and 2022. The share of the total arable land used for food potato cultivation was 2% in 1999 but had decreased to 0.8% in 2022.

When it comes to fruit and berries, mainly strawberries and black currants were grown in Norrbotten County. Between 1999 and 2017, the area used for strawberry cultivation decreased by 13 hectares, which corresponds to 52%. The area used for growing black currants decreased by 45 hectares, i.e. 35%. In 1999, there were 22 companies with strawberry cultivation in the county. In 2017, there were only 7. During the same time period, the number of companies growing black currants decreased from 36 to 13. The harvest of strawberries decreased by 40 tons, which corresponds to 77%. At the same time, the harvest of black currants decreased by 105 tonnes, i.e. 92%.

The pastureland in Norrbotten increased by 322% between 2003 and 2022 (Figure 108). As much as 86% of the county's pasture consisted of hayfields. Pasture, with grass and herbs, accounted for 12%, while forest pasture and unspecified pasture together accounted for the remaining 2% of the pasture area in the county.

▪ LIVESTOCK (EXCEPT REINDEER)

Although the conditions to produce grass for ruminants are very good in Norrbotten, the grazing season is short, so the livestock must be kept inside for large parts of the year. Forage-based milk and meat production gives a lower yield than when more concentrate is used. To be able to assert itself in the competition, grain and protein feed are therefore bought into the region today from other parts of Sweden.

In Norrbotten, the number of cows has decreased, while pigs and sheep have increased, since 1980 (Figure 112). In the 1930's, the number of cows were approximately 56,000, but after that, the number of cows decreased sharply during the 1950s and 1960s. In 2022, there were 4,552 dairy cows and 11,369 other cattle in Norrbotten (Swedish Board of Agriculture, 2023).

Both the number of dairy cows and the number of companies with dairy cows in the county have decreased. Since 1999 until 2022, the number of dairy cows has decreased by 49% (from 8,937 to 4,552).

During 1999-2019 the number of companies with dairy cows decreased from 337 to 66, which corresponds to 80%. On average, each company in the county owned 27 dairy cows each in 1999. In 2019, the corresponding figure was 76 dairy cows per company. The number of other cattle in Norrbotten has also decreased (26% between 1999 and 2022, from 15,280 to 11,369), see Figure 112, mostly due to the decrease of combined dairy and beef production. The number of cows used only in beef production has increased from 454 in 1999 to 1,334 in 2022. During 1999-2019, the number of enterprises with beef cattle decreased by 67%: from 516 to 168. The average number of 57 beef cattle per company in 1999 increased to 96 in 2019.

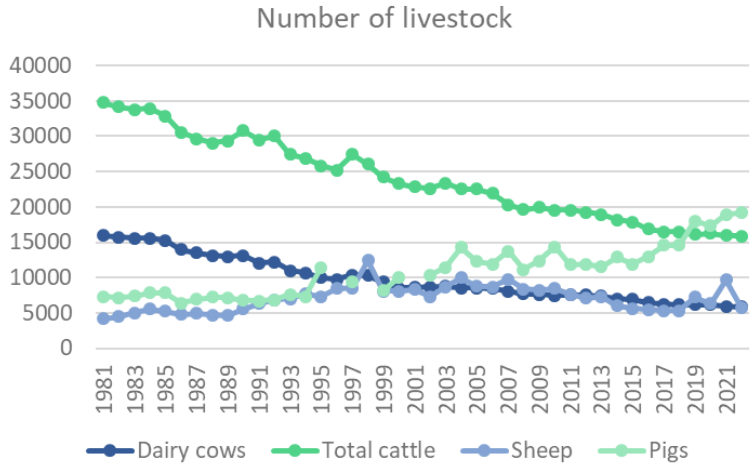


Figure 112. Number of livestock in Norrbotten, 1981-2022. Source: Swedish Board of Agriculture, 2023

In contrast to the number of cows, the number of pigs in Norrbotten has increased, see Figure 112. Since 1999, the increase in pigs corresponds to 136% (8135 pigs in 1999 compared with 19,171 pigs in 2022). The number of companies with slaughter pigs decreased from 8 to 6 between 2003 and 2017.

The number of sheeps in Norrbotten decreased by 14% between 1999 and 2022. The number of lambs decreased by 40% during the same time period. Of the total number of sheeps in the county, 52% were lambs in 1999. The corresponding proportion in 2022 was 43%. The number of companies with sheep decreased by 45% during 1999 and 2019. Between 2000 and 2019, the number of companies with lambs decreased by 55%.

The number of poultries in Norrbotten County has varied a lot, with very low numbers during 2001-2010, see Figure 113. In 2022 the numbers of poultry were about 41,000. The number of companies with poultry decreased by 63% between 2000 and 2019.

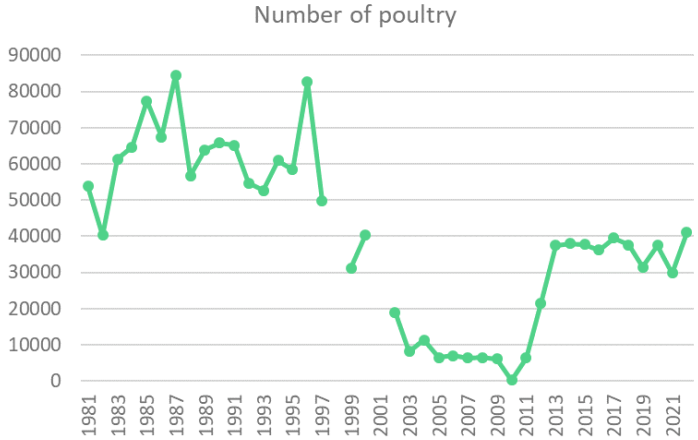


Figure 113. Number of poultry in Norrbotten county 1981-2021. Source: Swedish Board of Agriculture, 2023

In 2016, there were 1,261 agricultural companies in Norrbotten. In 1999, the corresponding figure was 1907, hence agricultural companies have decreased by 34% (compared with just over 21% for Sweden as a whole). Approximately 2% of Sweden's agricultural companies are located in the county. Most are small businesses. Agricultural enterprises with less than 30 hectares of agricultural land accounted for 81% of the total number of agricultural enterprises in the county in 2016. In 1999, the corresponding figure was 79%.

The number of full-time farmers in the county decreased by 51 % (from 345 to 170) between 2003 and 2016. In 2003, 26% of farms were full-time farms, while the same proportion in 2016 was 13%.

- FISHING

Fishing in inland waters and in the Bothnic Bay have traditionally been a very important economic sector for the inhabitants of Norrbotten County, and recreational and household fishing is still important for inhabitants and tourists. It is mostly small scale and it is increasing (Figure 114) (Swedish Agency for Marine and Water Management, 2020)

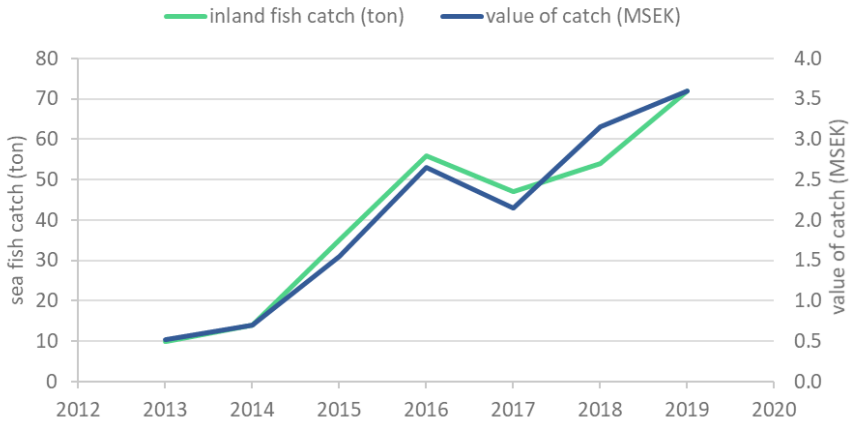


Figure 114. Fish catch in inland waters in Norrbotten County, as well as the value of the catch in millions of SEK

The fishing in the Bothnic Bay is for herring and vendace. Most of it is conducted by very few professional fishermen from outside of Norrbotten County and the catches are declining (Figure 115). (Swedish Agency for Marine and Water Management, 2020). The number of fishing vessels based in Norrbotten County is 115, of which 103 are small, under 12 meters (Swedish Agency for Marine and Water Management, 2023).

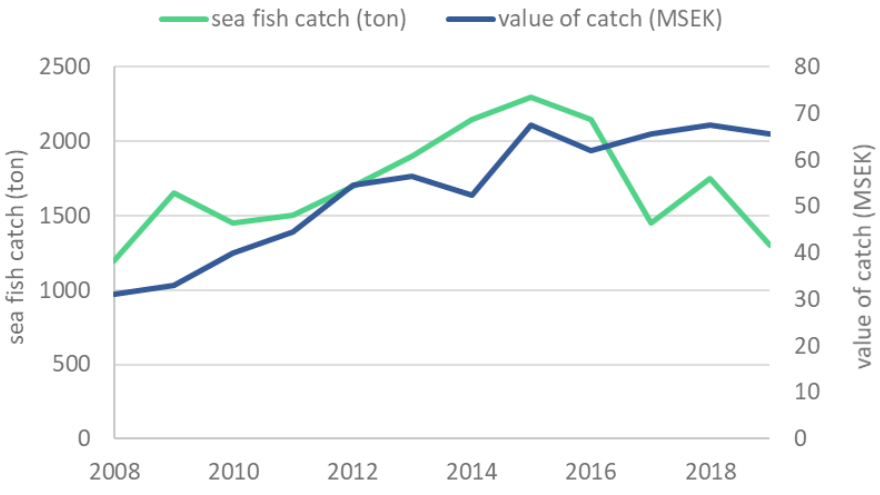


Figure 115. Fish catch in Bothnia Bay outside Norrbotten County, as well as the value of the catch in millons of SEK

In northern Sweden (i.e. Norrbotten County and several other counties), there are 28 fish farms producing fish for consumption, and 22 fish farms for production of small fish for fish stocking. A few of these farms are located in Norrbotten County. The production of farmed fish for human consumption is increasing (Swedish Agency for Marine and Water Management, 2020) and most of the Swedish production of farmed fish comes from northern Sweden.

○ Tourism, leisure and cultural heritage

Nature-based tourism is very important for Norrbotten. In Norrbotten, there are eight national parks and about 430 nature reserves.

Norrbotten offers everything from national parks to tree hotels and is a great area for outdoor activities like skiing, dog sledding and trekking. The Icehotel in Jukkasjärvi has been an important attraction for nature-based tourism of foreign tourists in Norrbotten.

Tourism in Norrbotten is mainly characterized by nature-based tourism, hence experiences and activities which allows the tourists to discover nature, such as the Northern Lights. In many cases, the tourism industry has developed these nature assets into a business that tourists are willing to pay vast amounts of money for (Sandlund & Öhman, 2020).

The tourism industry in Norrbotten is developing more towards "sustainable tourism" (Sandlund & Öhman, 2020). Tourists want to travel in a sustainable way and contribute to the place they are visiting. Furthermore, "simplicity" and "small-scale" are other important factors for tourism in Norrbotten, for instance doing things that is part of everyday life in Norrbotten, such as take a walk on the ice or pick berries in the wood. These activities can be considered exclusive for foreign tourists from other parts of the world.

In Norrbotten, the number of guest nights increased by 26% between 2009 and 2019, until the COVID pandemic, (Figure 116 and Figure 117). Since then, the number of guest nights have not quite recovered to the same levels as before the pandemic. In comparison, on a national level, the number of guest nights increased by 32% during the same time period (2009-2019), and are now back to the same level as before the pandemic.

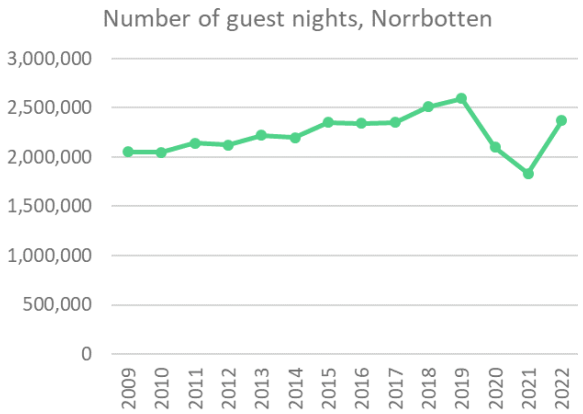


Figure 116. Number of guest nights in Norrbotten 2009-2022. Source: The Swedish Agency for Economic and Regional Growth and Statistics Sweden

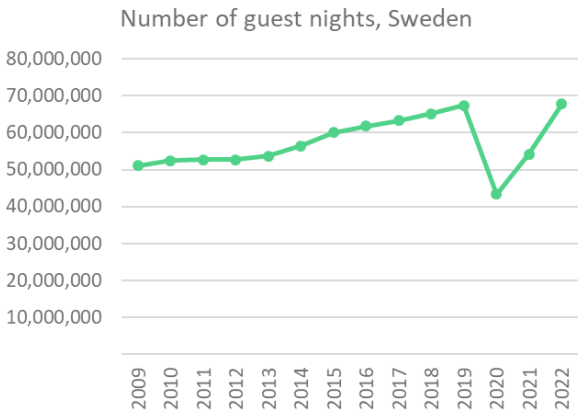


Figure 117. Number of guest nights in Sweden 2009-2022. Source: The Swedish Agency for Economic and Regional Growth and Statistics Sweden

Tourism during the summer has recovered to pre-pandemic levels in Norrbotten too, and the number of guest nights during the summer months (June, July and August) are now bigger than before the pandemic (Figure 116).

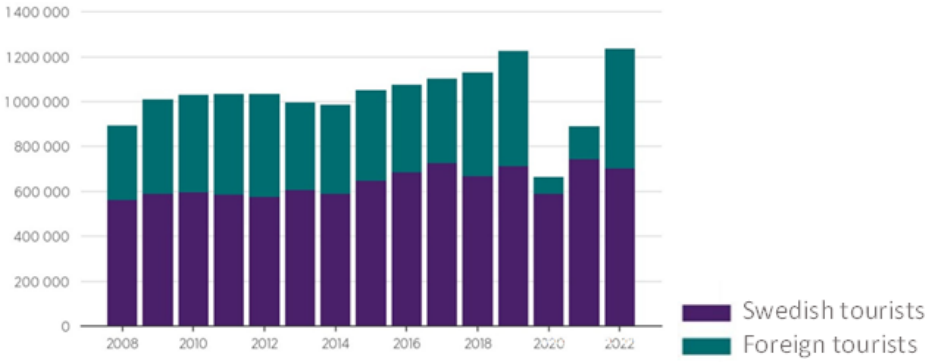


Figure 118. Number of guest nights in Norrbotten during June, July and August, 2008-2022. Reference: Sandlund & Öhman, 2020

○ Biodiversity and natural heritage

Most of Norrbotten county lies within the boreal biogeographic region. From the coast in the east, with its substantial archipelago, the land rises gradually towards the mountainous alpine region along the border to Norway in the west. Several large rivers traverse the county, among the major ones are the Torne River, the Lule River, the Kalix River, and the Pite River. The coastal areas and marine environments of the Bothnian Bay are unique in a European perspective as they are characterised by low salinity, low water temperatures, a long period of ice cover and low primary productivity. These special conditions create a naturally species-poor ecosystem that is sensitive to disturbances (Belgrano et al, 2018). Although there are areas with agriculture along the coast and in patches along the river valleys, in terms of area, most of the county consists of forest. According to official statistics, 60% of the total land area is forested while 12% is comprised of open mire. 29% falls in the category "other land" which is mainly made up of the mountainous vegetation types above the tree line in the western part of the county (Statistics Sweden, 2023b).

The boreal forests of Norrbotten mainly belong to the taiga type, dominated by a few conifer tree species, primarily Norway spruce (*Picea abies*) on moister ground and Scots pine (*Pinus sylvestris*) on drier ground (European Environment Agency, 2002). The region's extensive mires are important both from a climate perspective, as they store large amounts of carbon, as well as from a biodiversity perspective. Although bogs and fens generally have relatively low species-richness, such habitats have great significance for several specialised species, including birds and insects. The county's numerous lakes and waterways are similarly diverse habitats which host substantial populations of economically important fish species of the family Salmonidae, as well as pike (*Esox lucius*), perch (*Perca fluviatilis*) and burbot (*Lota lota*) (European Environment Agency, 2002). In the alpine region in the west, the tree line is formed by mountain birch (*Betula pubescens ssp. czerepanovii*), which grows to an altitude of about 500-600 m.a.s.l. The mountain birch forms a strip of birch forest between the taiga and the alpine tundra which covers an altitudinal range of about 200 m and is characteristic for the Scandes mountains.

Above the mountain birch forest, the low alpine level is characterised by a well-developed treeless vegetation cover, including mires and low shrubs. In the mid-alpine level, dominant plants are sedges, grasses and rushes along with certain herbs. Finally, the high alpine level lacks continuous vegetation and bare rock and boulder fields characterise extensive areas. Only scattered plants occur while lichens and bryophytes are more frequent. The flora in the alpine zone of the Scandes is relatively poor,

numbering around 250 vascular plants species compared to 650 found at the same level in the Alps (European Environment Agency, 2002).

Norrbotten has the largest area as well as the highest proportion of protected nature of any county in Sweden – a total of 2,652,529 hectares of nature is protected. 2,430,515 hectares consists of land area, which corresponds to 25% of the county. For Sweden as a whole, 12% is protected (Statistics Sweden 2023a). The largest part of the protected land in Norrbotten is in nature reserves, but the county is also home to 8 of the country's 30 national parks which accounts for 81 percent of the total national park area. This reflects the fact that the largest areas of protected land in Sweden are found in the sparsely inhabited mountain regions in the north of the country (Figure 119).

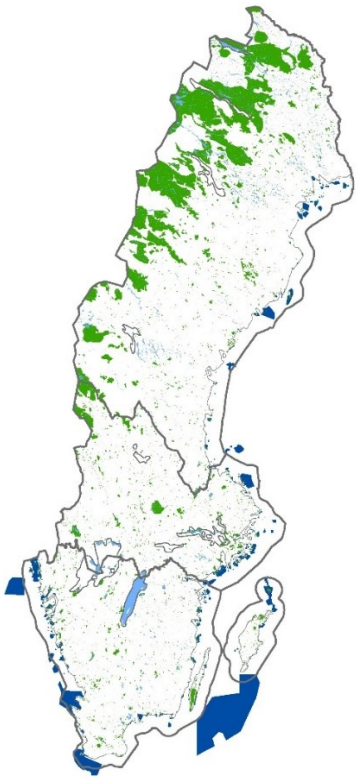


Figure 119. Protected areas in Sweden. Green: land area; light blue: freshwater; dark blue: marine protected areas. The area of protected nature is largest in the north, and especially in the mountainous region (SLU Artdatabanken, 2022)

The latest edition of the Swedish red list, published in 2020, showed an increase in red listed species specific to Norrland (the northern part of Sweden which consists of the counties Norrbotten, Västerbotten, Jämtland, Västernorrland and Gävleborg) by 19% since 2015. Clear-cutting of forest is classified as the most common threat among these species, followed by climate change, overgrowth of previously open landscapes, water-level regulation of rivers and drainage of wetlands. The status and impact factors for threatened species tend to vary geographically. The central parts of Norrland are subject to intense exploitation in the form of forestry and hydropower and there are few protected areas, while in the mountainous regions there are large areas of protected nature, and the conservation trends of species is generally better (Eide, et al., 2020). A similar pattern is seen in Sweden's assessments of conservation status for the species and habitats that are listed in the EU Habitats Directive, which were reported to the EU in 2019. The conservation status of alpine habitat types is predominantly assessed as good (for the period 2013-2019) while, in contrast, the conservation status of forest habitats is assessed as poor, due to insufficient protection and negative

impacts resulting from present-day forestry (Swedish Environmental Protection Agency, 2020) (Figure 120).

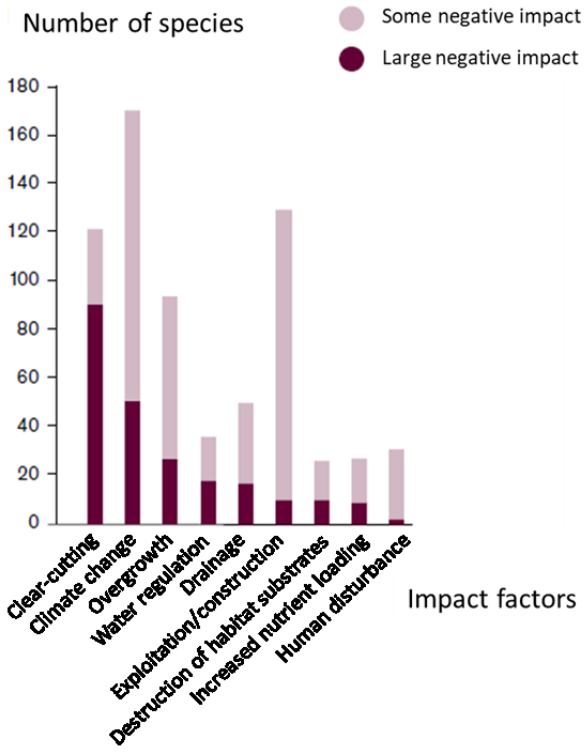


Figure 120. The most important impact factors for red-listed species found in northern Sweden (Eide et al, 2020)

○ Mining and quarrying

In Sweden there are 12 mines in total, see Figure 121. Currently there are five mines in Norrbotten, and all of them are metal mines, four iron mines and one mine of mainly copper ore (the Aitik mine), see Table 33. The oldest of the mines in Norrbotten has been in operation since the 1820, according to SGU (Geological Survey of Sweden).

The Aitik mine is one of the largest copper mines in Europe. The Aitik mine started in 1968, and since then the annual production of ore has increased from 2 Mt, to 43.3 Mt (year 2022). In 2022 the production of ore in the Aitik mine increased with about 8% compared with 2021. The reserves and assets found in the Aitik mine and nearby deposits will probably last for many decades of ore production. The ore in Aitik is porphyry copper, an ore type characterized by low metal contents but with a very large amount of ore. In addition to copper, silver and gold are also mined in the Aitik mine.

Table 33. Metal mines in Norrbotten. Source: SGU (2023)

Mine	Mining company	Mineral	In operation since
Aitik	Boliden Mineral AB	Copper, gold, silver	1968
Malmberget	Luossavaara-Kiirunavaara Aktiebolag	Iron	1820s
Kiirunavaara	Luossavaara-Kiirunavaara Aktiebolag	Iron	1860s
Leveäniemi	Luossavaara-Kiirunavaara Aktiebolag	Iron	1964–1983, 2015 restart
Kaunisvaara, previous Tapuli	Kaunis Iron AB	Iron	2012–2014, 2018 restart

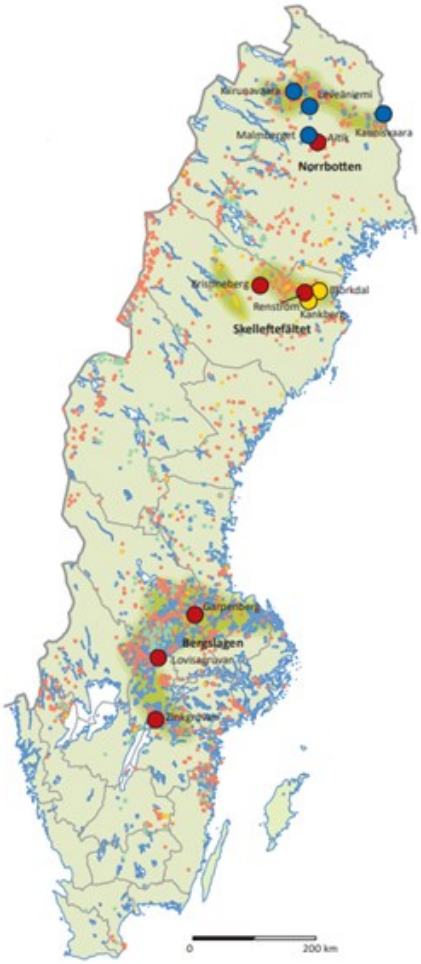


Figure 121. Active mines and known mineralisations in Sweden 2022. Source: SGU (2023)

Total ore production of both iron and non-ferrous ore in Sweden has nearly doubled over the past ten years, are shown in Figure 122. The increase can be partly attributed to the Aitik mine. However, production increases have also taken place in the other mines. In Norrbotten, the number of workers in the mining industry has increased by 37 % between 2000-2022 (Figure 123).

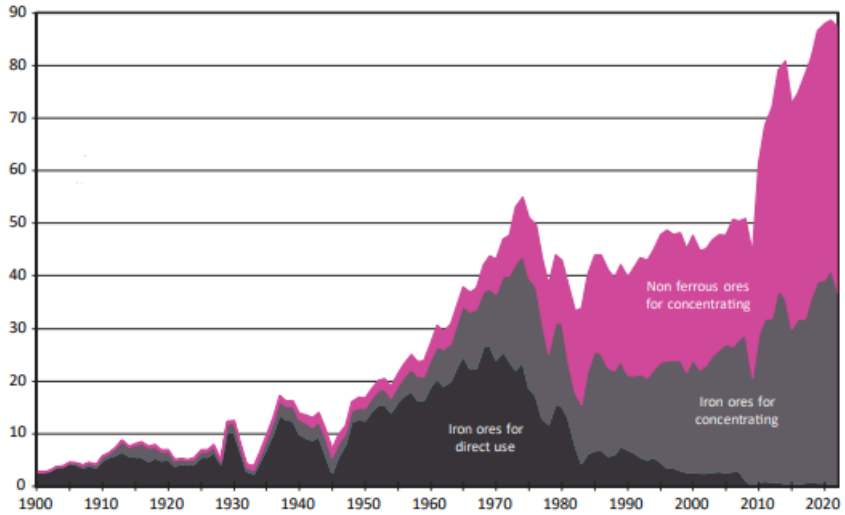


Figure 122. Production of ores (millions of tons) in Sweden 1900-2022. Source: SGU (2023)

Figure 123. Number of workers in the mining industry in Norrbotten, 2000-2022. Source: SGU (2023)

○ Energy

Norrbotten has high energy consumption because of the local climate, long transports and the local industry's involvement in high-energy processes.

The **total end use of energy** in Norrbotten in 2018 amounted to approximately 31 terawatt hours (TWh). Figure 124 shows how the energy use was distributed between different fuel categories. The figure shows that the renewable energy use in the county amounted to around 50% in 2018.

In Norrbotten, fossil energy use consists of oil, coal and coke. The large use of coal and coke in the county can be traced to SSAB's operations in Luleå, where steel is manufactured with coal as an input, as well as to the production of iron pellets in Kiruna and LKAB (Energi- och klimatöversikt för Norrbottens län 2020).

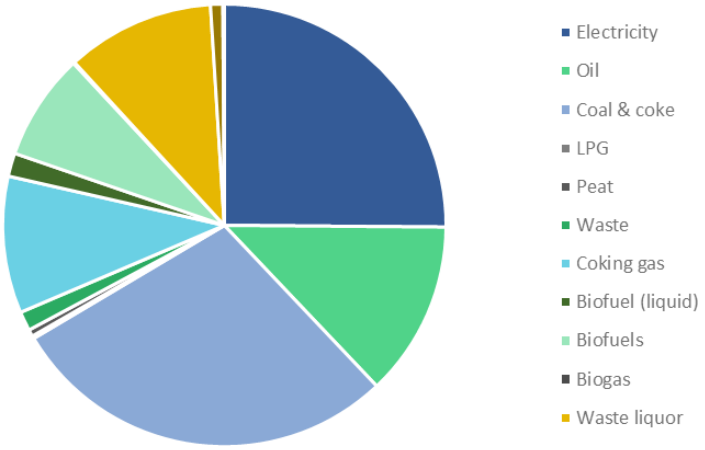


Figure 124. Energy use distributed between different fuel categories

Future investments in the county may fundamentally change the distribution between the different types of energy. Above all, it concerns investments in producing fossil-free iron and steel. In today's system, coal and coke are used and steel production in Luleå alone accounts for nearly 10% of Sweden's total CO_2 emissions. These energy sources must in future systems be replaced with hydrogen that is split from water via electrolysis. This will generate water vapor as emissions, instead of carbon dioxide (Energi- och klimatöversikt för Norrbottens län 2020).

In the county, **hydropower** accounts for nearly 90% of the electricity produced. In the county, only the Piteälven and Kalixälven rivers are not developed, and historically, hydropower has been of great

importance for the establishment of heavy industry that exist in the county today (Energi- och klimatöversikt för Norrbottens län 2020).

Norrbotten has had a strong expansion of **wind turbines** in the last years. Europe's largest wind farm is currently being built in Markbygden outside Piteå. In 2026, the wind farm is planned to be fully developed, with just over 1,100 wind turbines estimated to be able to deliver 12 TWh per year. In 2019, there were 372 wind turbines in the county, which together added approximately 2 TWh to the regional energy system today (Energi- och klimatöversikt för Norrbottens län 2020).

The installed power of grid-connected **solar cell** facilities in the county has increased from 2016, albeit from low levels. In 2019, the total installed power was close to 5 MW distributed among just over 200 facilities. The total installed effect in Sweden was 698 MW in the same year. Norrbotten and the adjacent county Västerbotten were the counties that had the lowest in 2019 installed power in the country today (Energi- och klimatöversikt för Norrbottens län 2020).

The **electricity demand** in Norrbotten is expected to increase from the present level of just over 8 TWh (2019) to approx. 107 TWh in 2050. If all these industrial plans and all electricity needs will be realized, we will only know in 25 years or so. This is a very large increase, above all with regard to the fact that electricity production is estimated at "only" about 30 TWh as we approach 2030. The conclusion is thus that if all the planned industries that are to be established in Norrbotten can be realized, the electricity supply must increase a lot, either by building a lot more electricity production and, or, by importing significant amounts of electricity. As a large part of the appreciated electricity demand is linked to hydrogen production, another alternative is to produce hydrogen outside the county and transport it (*Norrbottens framtida elbehov. En kartläggning och uppskattning av regionens behov fram till 2050,* Energikontor Norr 2022).

5.1.2. Climate change factors analysis: adaptation and mitigation baseline

The emissions trend in the case study area is developed using the Emissions Database for Global Atmospheric Research (EDGAR[51]) which provides CO_2 emission data for Norrbotten (Övre Norrland). The evolution of the emissions for this coupled region is presented in Figure 125.

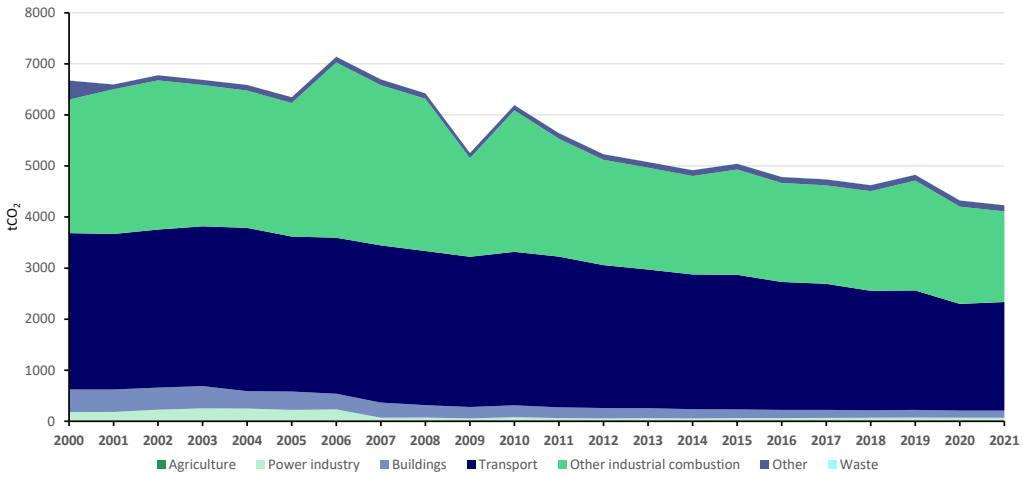


Figure 125. Evolution of CO_2 emission in Norrbotten and Västerbotten region between 2000 and 2020. Source: Own calculation based on EDGAR data.

Considering the data presented in the Figure 125, a very large decrease in emission levels is observed in the region. Industrial combustion join transport as the main principal CO_2 emitters in the region

[51] https://edgar.jrc.ec.europa.eu/

followed by buildings. Although the emissions have been reduced by more or less 30% since 2000, it is necessary to highlight the need to continue with the implementation of measures to reduce the emission levels in the two main emitter sectors.

After the development of a baseline or inventory of CO_2 emissions, to complement the emission analysis, the carbon stock in vegetation and soil is provided (Figure 126) using geolocated data from ESA Biomass Climate Change Initiative[52] and Global Soil Organic Carbon Map (from FAO)[53], on soil organic carbon and biomass stock that was translated in carbon stock using default values provided by the IPCC. As a result, the carbon stock in soils is higher the 12,090,168.96 $MgCO_2$, while the carbon stock in the biomass increases to 358,643,949 $MgCO_2$. The evolution of carbon stock in biomass along the year with available data is represented in Figure 127. It is observed how the carbon stock in the biomass has been reduced in a very visible way since 2010.

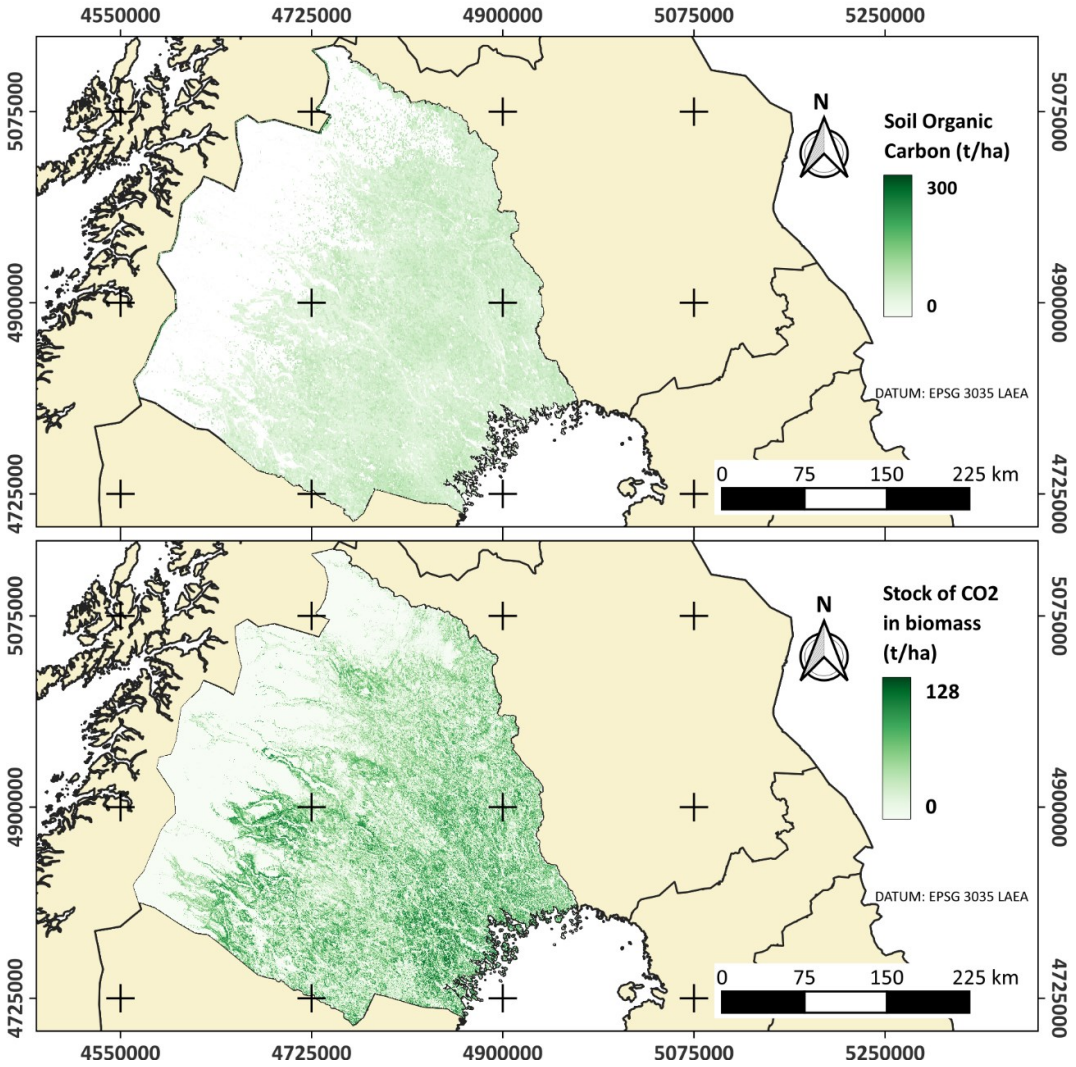


Figure 126. Carbon stock (tCO_2) in soils (top) and carbon stock (tCO_2) in biomass for Norrbotten in the reference year. Source: Own calculation based on ESA Biomass Climate Change Initiative and Global Soil Organic Carbon Map (from FAO) data respectively.

[52] https://data.ceda.ac.uk/neodc/esacci/biomass/data/agb/maps/v4.0
[53] https://data.apps.fao.org/glosis/?share=f-6756da2a-5c1d-4ac9-9b94-297d1f105e83&lang=en

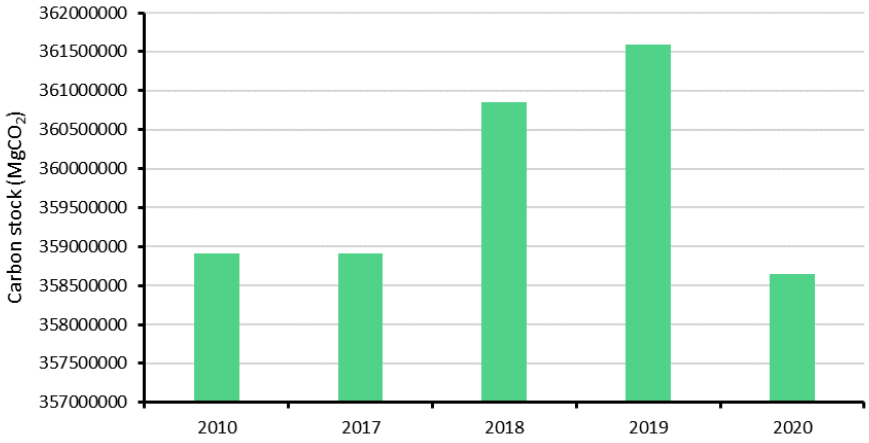


Figure 127. Carbon stock in biomass ($MgCO_2$) for Norrbotten between 2010 and 2020. Source: Own calculation based on Global Soil Organic Carbon Map (from FAO) data.

5.1.3. Past experience and legal framework analysis

For the past experience and legal framework analysis of Norrbotten Case Study, 39 documents were identified and high-level characterised within key fields. From them, 13 were selected as the most relevant and interesting ones, and were further analysed.

The detailed information of this analysis can be consulted in Annex 3 in section 11.5. The following Table 28 includes the relation of those documents analysed deeply and few key aspects on them. This legal framework will help to define the starting point for policy implementation considering the most important sectors and the associated climate change impacts.

Table 34. Relevant documents analysed for CS3 Norrbotten County.

#	Name of the document	Type	Scope	Year	Main sectors
1	**A National Food Strategy for Sweden** – more jobs and sustainable growth throughout the country	Strategy	National	2017	• Agriculture, forestry and fishing • Society
3	**National energy and climate plans – Sweden**	Plan	National	2020 (-2030)	• Energy
10	**Nature conservation agreement Guidelines for application**	Guideline	Sectoral	2013	• Biodiversity and natural heritage • Agriculture, forestry and fishing • Tourism, cultural heritage
14	**Proposed national plan for transport system 2018–2029**	Plan	National	2018 (-2029)	• Transport • Cities and urban planning
18	**Regional development strategy Norrbotten 2030**	Strategy	Regional	2018 (-2030)	• Transport • Industry and commerce • Society
19	**Regional plan for climate change adaptation**	Plan	Regional	2020	• Agriculture, forestry and fishing • Mining and quarrying • Energy • Biodiversity and natural heritage • Tourism, cultural heritage

#	Name of the document	Type	Scope	Year	Main sectors
23	**Regional Action plan for countryside program and ocean and fishery program**	Plan	Regional	2021	• Agriculture, forestry and fishing
25	**Norrbotten food strategy action plan 2022-2025**	Plan	Sectoral	2022 (-2025)	• Agriculture, forestry and fishing • Society • Biodiversity and natural heritage
26	**Program for conservation areas in Norrbotten county 2012–2016** (still current)	Plan	Regional	2012 (still current)	• Agriculture, forestry and fishing • Biodiversity and natural heritage
28	**Norrbotten climate and energy strategy 2020–2024**	Strategy	Regional	2020 (-2024)	• Energy • Society • ICT
30	**Plan for water shortage and drought 2021 - 2027 for the Bothnian Bay**	Plan	Regional	2021 (-2027)	• Agriculture, forestry and fishing • Water and waste
33	**Action plan for climate adaptation by The Sami Parliament**	Plan	Sectoral	2017 (still current)	• Agriculture, forestry and fishing • Biodiversity and natural heritage • Tourism, cultural heritage
35	**Action plan Connected to The regional forestry program for Norrbotten County**	Plan	Sectoral	2020	• Agriculture, forestry and fishing • Biodiversity and natural heritage • Tourism, cultural heritage

5.2. PESTLE results for the local ecosystem drivers' analysis

This section discusses how the impact of climate change, and adaptation and mitigation policy implementation are affecting the Norrbotten region based on political, economic, social, technological, environmental and legal factors. Table 35 below provides details of the key items collected for each PESTLE factor. The sources for the information provided in the table are from the data collection results which came from the different exercises with stakeholders, the case study leader and supporter to identify the main drivers and the data sources to understand the local ecosystem (reported in section 11.6 Annex 6. Case Study 3 – Boreal region (Norrbotten): PESTLE results for the local ecosystem drivers' analysis). The process to complete this PESTLE was explained in the methodological part of this document (section 2.2).

Table 35. Results from Norrbotten PESTLE analysis.

Factors	Category	Details	Impact status
Political	Governmental policy	Urban and regional planning. ▪ Local policies and initiatives. ▪ Development Strategy. ▪ Rural development strategy.	Positive
	Environmental and sustainable policy	Land use. ▪ Organic Farming. ▪ Urban planning. ▪ Climate and Energy Strategy. ▪ Strategy for the mineral sector.	Positive
	Issues	Political Governance and composition. ▪ Not binding Municipal plans. ▪ Prioritization of National Interest Areas. ▪ Levels of government conflicting. ▪ No Strategy for Climate Adaptation.	Negative
	Targets	Net Zero CO_2 emissions in 2045, plus supplementary measures. ▪ Efficient use of energy. ▪ Total renewable energy production in 2040.	Positive
Economical	Energy and resources	Natural resources for different activities. ▪ Certified wood products. ▪ Use of biomass from trees. ▪ Efficient use of natural resources.	Positive
	Economic investment	Industrial investments with effective solutions. ▪ Financial support by largely governs. ▪ LIFE Programme. ▪ Green bonds investors. ▪	Positive

Factors	Category	Details	Impact status
		Diversification of the investment activities. ▪ Support for irrigation dams. ▪ Water conservation measures. ▪ Compensation from hydro-power.	
	Opportunities	Green employment. ▪ Increasing tourism. ▪ Support to entrepreneurs.	Positive
	Taxes and costs	Climate adaptation measures taxes. ▪ Rural development programme. ▪ LOVA and LONA grants. ▪ MSB. ▪ Water and sewerage tax. ▪ Feeding in the reindeer industry.	Neutral
Social	NGOs	Alliances between NGOs and Sami communities. ▪ Rural development NGO "Hela Sverige ska Leva". ▪ Extinction Rebellion subgroup "Rebellmammorna".	Positive
	Development and employment	Employment in mining and steel production. ▪ Wind power and hydrogen sector. ▪ LEADER investment.	Positive
	Opportunities	Promotion of efficient use of resources. ▪ Lower emissions and decarbonisation of transport. ▪ Tax-revenue from employment and migration. ▪ Exploitation of the cultural heritage. ▪ Awareness of environmental justice and indigenous rights.	Positive
	Society lacks	Awareness of challenges. ▪ Cooperation. ▪ The Nature Conservation Society. ▪ Local associations. ▪ Proactivity and commitment.	Negative
	Reindeer husbandry	Sami culture change. ▪ Unemployment rate.	Negative
	Equality	County administrative board. ▪ Equal access to education. ▪ Equal access to health care. ▪ End men's violence against women.	Positive
Technological	Production improvement	Improvement of renewable energy production, especially off-shore windfarms. ▪ Development of wind power technologies.	Positive
	R&D	Local actors for innovation, research and mitigation/adaptation from climate change. ▪ Improvement of digitalization. ▪ Research on adaptation/reduction of climate change by county Technical University. ▪ The SMALL-project, Smart Viable Countryside.	Positive
	Potential investment	Development of train. ▪ Use of old peat extractions to produce solar farms. ▪ New hydrogen system. ▪ Use of heat waste in a green house.	Positive
	Development	Broadband access development. ▪ Fossil free industry. ▪ Recycling of mining waste.	Positive
Environmental	Sustainability	Change on the species of the ecosystems. ▪ Large protected areas. ▪ Wetlands and streams are being restored. ▪ Continuous cover forestry is increasing.	Positive
	Positive business	Larger agriculture production season and more crop species available. ▪ More hydropower use due to the increasing precipitation. ▪ Wind farms due to wind speed.	Positive
	Carbon footprint	More carbon capture due to the development of trees growth. ▪ Energy consumption reduction.	Positive
	Initiatives	Project for the protection and conservation of protective areas and forests.	Positive
Legal	Legislation required	Laws, frameworks and targets related to climate change. ▪ Planning and Building Act legislation. ▪ The Ordinance on Adaptation (climate and vulnerability analysis, adaptation plans…). ▪ The Reindeer Husbandry law "Rennäringslag".	Positive
	Equal opportunities	Equality and non-discrimination law.	Positive
	Environmental legislation	Apply of Natura2000. ▪ Environmental Impact Assessment required. ▪ Protected areas with specific legal status. ▪ Reports of risks of climate change. ▪ The Swedish Environmental code. ▪ Voluntary Nature conservation agreements.	Positive
	Issues	Rights to land, hunting and fishing (Sami, herders, and “ordinary” Swedes).	Positive

Considering the **political factors**, the relevance of plans and strategies can be seen as factors that help to stimulate the adoption of measures to reduce the impact of climate change through the reduction of emissions and the land use and urban management. However, it would be important to develop a Strategy for Climate Adaptation that would help to achieve the national and international targets, as

well as better political governance structure on climate change aspects. Sustainable targets towards climate change mitigation and adaptation are set, and the development of initiatives and incentives can also be key to contribute to the sustainability of the region, its resilience and adaptation to climate change.

With respect to the **economic factors**, investment in energy efficiency and water and forest management can serve to guide the population's capacity to become climate aware and advance in the decarbonization of the region's economy through the improvement in the use of resources. It must be considered that the GDP per capita in 2021 was 53,114 €, highlighting its increase of 22.3% compared to the previous year, greater than the values prior to the pandemic caused by COVID-19 (44,696€). The regional GDP value is significantly higher than the national average (44,023 €), which is an indicative of a good economy situation and high development, and awareness of the population.

Social factors in the Norrbotten region are influenced by the population, its evolution and the equality aspects. The population has slightly decreased in recent years, reaching 249,285 inhabitants in 2022 (1st of November), which represents a decrease of 1.6% compared to 2021. The distribution between men and women is almost equitable, the 51.4% of population are men (7,000 more men than woman). This population decrease is due to migration rates that cause population fluctuations, mainly conditioned by climate conditions (cold temperatures and high precipitation). In the region, the Gini coefficient ranges between 0.22 and 0.28 depending on the municipality, which gives an idea that incomes are not very different among the population. There are NGOs and local authorities that enable training campaigns to improve the population's awareness of the reality of climate change and indigenous rights and culture guide the promotion of actions in the region.

Technological factors consider the role of technology as a driver to guide adaptation and mitigation against climate change. Norrbotten has several local actors that guide the research, development and innovation activities in the region, with great interest in decarbonization, improvement of accessibility to broadband and public transport and wind energy development. These activities make the population to become aware of the use the available resources. More than 100 billion € are going to be invested in the development of power installations for industry and wind power, as well as in maintenance of the power grids. This is a clear indicator on the commitment of the region with energy transition and efficiency.

Regarding **environmental factors**, initiatives at different scales to improve energy efficiency and carbon capture to reduce carbon footprint, as well as to improve the protection of forests and protected areas. There are several projects and initiatives implemented in the region that seek to protect and maintain well-conserved forests, since almost 60% of the total area is forest. This informs about the interest and commitment of regional and local administrations to protect environment and ecosystems related to forests.

Finally, **legal factors** must be analyzed, since they are directly related to the legislative framework and regulations to manage nature conservation and risks analysis. Initiatives to protect both the environment and the fight against social inequalities and achieve gender parity must be highlighted. Above all, the relevance of alliances between Sami communities, herders and "ordinary" Swedes are key to ensure the region's management and its resilience.

5.3. Summary of case study characterization in Norrbotten

Norrbotten County is Sweden's northernmost county. According to the climate and weather analysis under historical conditions and the projection to future period, the mean annual daily temperature will increase more than 5.7ºC in the most unfavourable scenario, being more than 7ºC by 2100. With respect to the evolution of precipitation, the future shows a slightly increasing trend, being the mean annual daily cumulated precipitation forecasted to increase 21.70% in the most unfavourable scenario.

The maximum annual daily cumulated precipitation is expected to increase as well, which represents more torrential events.

This climate tendency affects also the key vulnerable sectors in Norrbotten, identified by case study leaders and supporters, considering also the view of the local stakeholders. These are the agriculture sector including the key sector of reindeer husbandry, tourism, biodiversity, as well as mining and energy with a second priority level. Forestry is also an important sector for Norrbotten County, as the 40% of the surface is covered by productive forest. This is thanks to the cold climate, in which trees grow slowly and get a dense wood of high quality. Reindeer husbandry is another important economic sector, especially for the Sami population. All reindeer in Sweden are domesticated, they graze in forests and on the mountains. The yearly economic value of the reindeer meat and other products are around 3.6 million € (or 4.2 million € with subsidies).

Nature-based tourism is very important in Norrbotten, with experiences and activities that allow tourists to discover nature. There are eight national parks and about 430 nature reserves. Tourism industry is developing more towards sustainable tourism. The number of guests' nights was increasing until 2019 (26% from 2009), and now it is recovering to those levels after the COVID pandemic.

Most of the Norrbotten County is within boreal geographic region. Coastal areas and marine environments of the Bothnian Bay are unique in a European perspective, as they are characterised by low salinity, low water temperatures, a long period of ice cover, and low primary productivity. These special conditions create a naturally species-poor ecosystem. Most of the county consists of forest, the boreal forests mainly belong to the taiga type, dominated by a few conifer tree species. The region's extensive mires are important from a climate perspective, as they store large amounts of carbon, as well as from a biodiversity perspective. Although bogs and fens generally have relatively low species-richness, such habitats have great significance for several specialised species, including birds and insects. There are five mines in Norrbotten, and all of them are metal mines. Four out of these five mines are iron mines, and last one mine is mainly of copper ore, Aitik mine, which is the largest copper mine in Europe. Thus, mining is another relevant sector for the case study, with an increasing production and consequently increasing number of workers (37% between 2000 and 2022).

Norrbotten has high energy consumption because of the local climate, long transports and the local industry's involvement in high-energy processes. Although the renewable energy use is growing (52% in 2018 from the total energy use), it still largely consists of fossil fuels (such as oil, coal and coke). Hydropower accounts for nearly 90% of the electricity produced, and historically hydropower has been of great importance for the establishment of heavy industry. It also has a strong expansion of wind turbines in the last years, and the solar cell facilities is also increasing

The adaptation and mitigation baseline have been analysed as well, and the emission levels present a large decrease in the recent years (around 30% since 2000). Industrial combustion and transport are the main CO_2 emitters in the region, followed by buildings. The carbon stock in vegetation and soil can be highlighted, especially the capacity for carbon stock in biomass.

As per the past experiences in the Norrbotten County, a total of 39 documents were analysed at high-level, and 13 out of them were further analysed due to their relevance, including the National Food Strategy for Sweden, the National energy and climate plan, the Nature conservation agreement, the Regional development strategy (Norrbotten 2030), Norrbotten food strategy action plan, Program for conservation areas in Norrbotten county, among others.

In accordance with the Local Council of Stakeholders of Norrbotten case study, the drivers considered as enabling factors for climate change policies implementation were analysed through the aspects of a PESTLE analysis. Among them, the following can be outlined: municipalities can have their own policies and drivers for local initiatives, there are national interest areas, Municipal master plans (that provides a general indication of land use, but not legally binding), set climate targets, municipalities

finance climate adaptation measures, rural development program, different grants available for sustainable measures implementation, new employment opportunities in mining, wind-power sector, and others, promotion and conversation of cultural heritage, as well as the increased productivity in agriculture and other key sectors.

6. Case Study 4 – Mediterranean region (Murcia region) characterisation

The Region of Murcia is an autonomous community of Spain located in the southeast of the Iberian Peninsula, on the coast of the Mediterranean Sea (Figure 128). With an extension of 11,313 km², it is the ninth largest region in Spain by area, representing the 2.9% of the total area of Spain. Considering the hydrology, the region of Murcia extends mostly in the Segura hydrographic basin with small areas located in other hydrographic basins.

The total population of the Region is 1,531,878 inhabitants in 2022 according to the data provided by the National Institute of Statistics of Spain (INE). Slightly less than a third of its population lives in the capital of the region. With a population density of 135 inhabitants per km^2, that is much higher than the mean population density of Spain. The Region is divided in 45 municipalities, being it total GDP of 32,205 million € in 2021 and the GDP per capita of 21,236 € in the same reference year. This GDP per capita is significantly lower than the national average. The region of Murcia is the third largest exporter of fresh fruits and vegetables in Spain, with more than 2.5 million of tons in total values with a monetary value higher than 2,564 million euros (reference data, 2019). In this sense the agricultural sector is a benchmark at regional level. Currently, its direct activity represents 24.3% of the total GDP of Murcia and indirectly affects approximately the 50% of the GDP. These values must be highlighted, considering that the region suffers important problems due to the lack of water and the associated water stress.

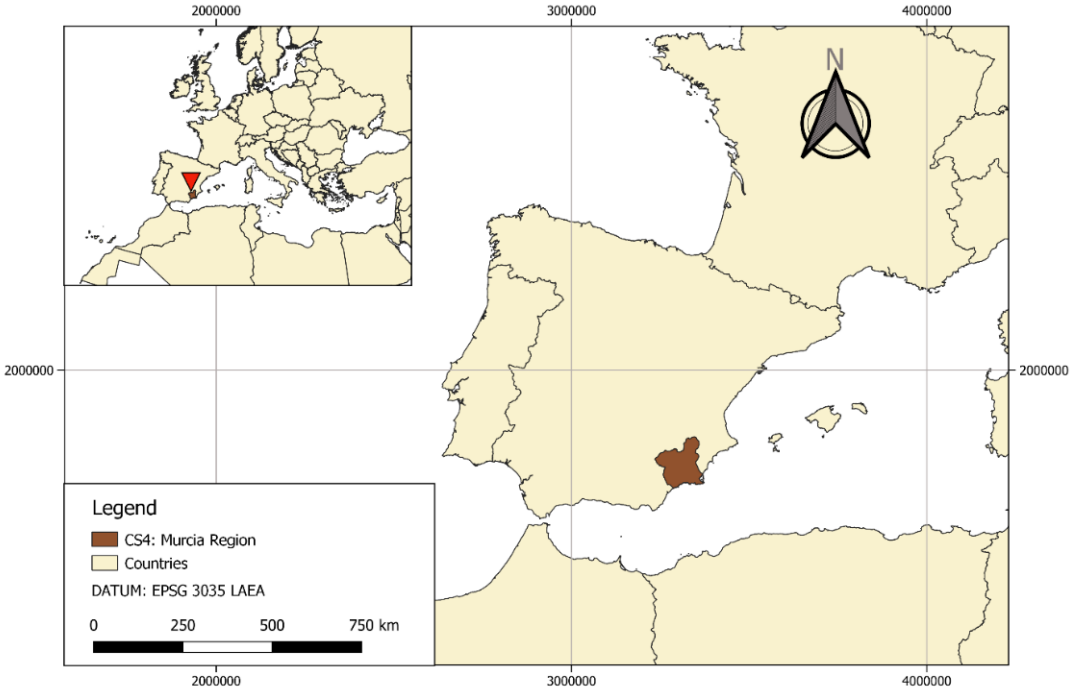


Figure 128. Location of CS4, Murcia Region.

The climate is defined as semi-arid subtropical Mediterranean. Among its characteristics, the thermal amplitude between seasons stands out, presenting hot summers and mild winters and the climatic differences between the coast and the interior areas, with temperatures that oscillate according to location altitude. In the Region of Murcia, rainfall is scarce and irregular (varies from 400 mm to 200 mm between areas) and it is concentrated in autumn and spring, appearing in torrential forms, leading to floods and torrential events.

6.1. Analysis of geographical landscape and historical climate conditions

This section includes an analysis of the historical and future climate in the Region of Murcia and also the main sectors that will be affected by forecast changes in the climate due to the increase of emissions and the associated effects in social, economic and environmental systems.

6.1.1. Climate analysis and characterisation of vulnerable sectors

In this initial section, two relevant objectives are covered: (i) an assessment of the main climate data (temperature, precipitation and wind) in the historical and future period (from 2023 to 2100) under two different climate scenarios for the region of Murcia and (ii) identification and description of the main assets per vulnerable sector that will be affected by future changes in the climate.

6.1.1.1. Climate and weather analysis

Climate analysis is based on the Essential Climate Variable (ECVs). More in detail, the following variables are evaluated: maximum annual daily cumulated precipitation, mean annual daily cumulated precipitation, mean annual daily maximum temperature, mean annual daily minimum temperature, mean annual daily mean temperature and mean annual daily mean surface wind speed.

- **Temperature**

If we analyse the obtained results of climate models in the future for temperature, we identified that the mean annual daily temperature in the Region of Murcia (15.47ºC in the historical period) will increase according to the two considered climate scenarios. It is expected that the mean annual daily temperature increases more than 4.9ºC in the most unfavorable scenario (SSP585) in the long term. In this sense, the temperature will increase more than 20ºC by 2100. Considering the minimum and maximum mean annual daily temperature, the same pattern is expected facing a warmer climate with very high temperature in extremes. Table 36 presents the temperature results in the Region of Murcia for two different scenarios (SSP245 and SSP585) and the comparison with the mean values in the historical.

Table 36. Mean, Maximum and Minimum temperature and related anomalies comparing with the historical. Lighter red colour implies smaller changes while dark red implies higher changes.

Scenario and period		Mean temperature	Mean maximum temperature	Mean minimum temperature
Historical scenario		15.47	19.85	11.46
SSP245 scenario	2023-2039	16.67	21.19	12.68
	2040-2069	17.40	22.04	13.36
	2070-2100	18.20	22.98	14.18
SSP585 scenario	2023-2039	16.77	21.30	12.69
	2040-2069	18.03	22.68	13.94
	2070-2100	20.40	25.34	16.31
Anomaly SSP245 scenario	2023-2039	1.20	1.33	1.22
	2040-2069	1.93	2.19	1.90
	2070-2100	2.73	3.12	2.71
Anomaly SSP585 scenario	2023-2039	1.31	1.44	1.23
	2040-2069	2.56	2.82	2.48
	2070-2100	4.94	5.49	4.85

Figure 129 presents the results of the evolution of mean annual daily temperature along the period 2015-2100 using downscaled data from eight different climate models for the SSP245 climate scenario. The average value for the eight models under SSP245 is presented in Figure 130 where the confidence interval is represented by the maximum and minimum value of the set of models in each simulation year. The same representation for the temperature variation under SSP585 climate scenario is included in Figure 131 and Figure 132 respectively. Results show a high heterogeneity between model results and scenario with a growing trend along the evaluated period in both scenarios, being higher the temperature increase in the most extreme scenario (SSP585).

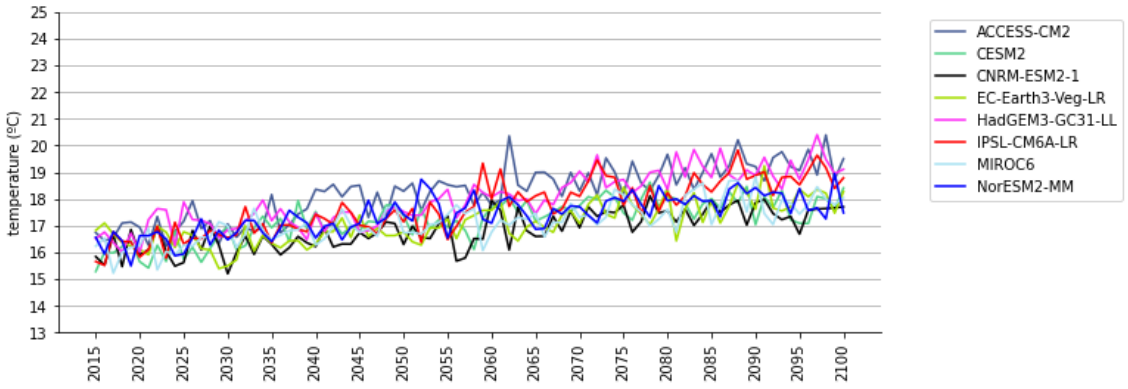


Figure 129. Mean annual daily temperature in the SSP245 scenario (2015-2100) for eight models in the region of Murcia obtained by statistical downscaling procedure.

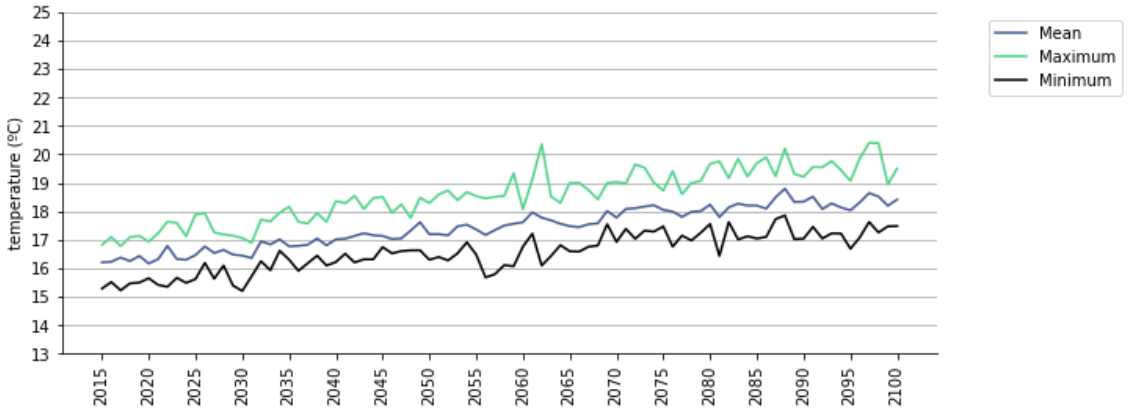


Figure 130. Ensemble mean annual daily temperate and range of variation (Maximum and Minimum) for a set of eight models in the SSP245 scenario (2015-2100) for the region of Murcia.

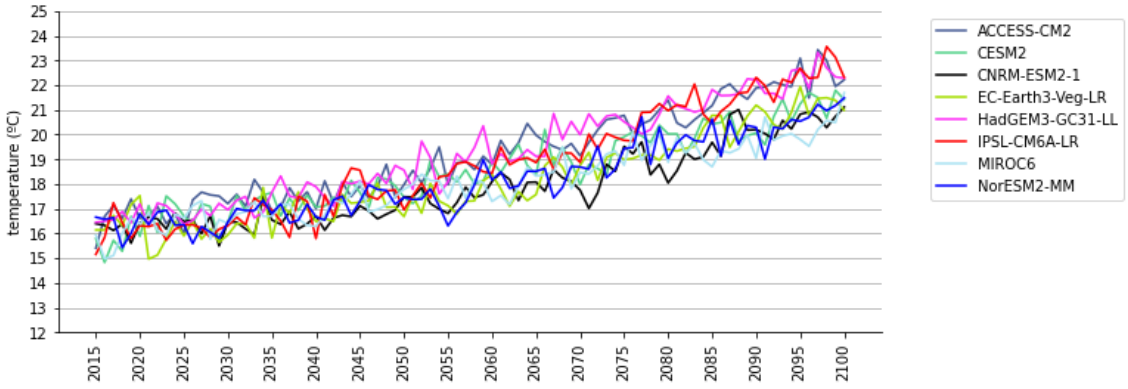


Figure 131. Mean annual daily temperature in the SSP585 scenario (2015-2100) for eight models in the region of Murcia obtained by statistical downscaling procedure.

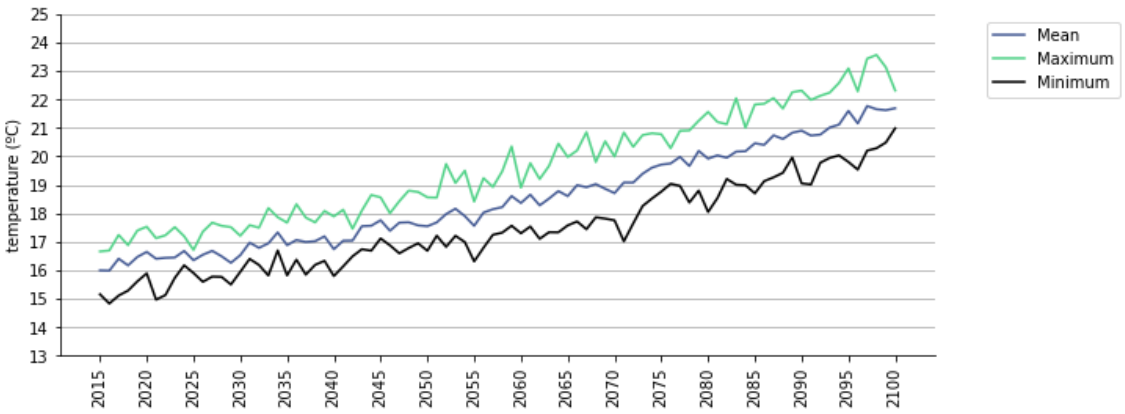


Figure 132. Ensemble mean daily annual temperate and range of variation (Maximum and Minimum) for a set of eight models in the SSP585 scenario (2015-2100) for the region of Murcia.

○ Precipitation

The evolution of precipitation in the future shows a slightly decreasing trend, which is completely contrary to that observed for temperatures, where a very pronounced increase is predicted. Considering its evolution throughout the time periods analyzed (Table 37), the decrease in precipitation will be more visible in the most unfavorable scenario (SSP585). The mean annual daily cumulated precipitation observed in the historical period is 1.06 mm/day, which is equivalent to an annual precipitation of 386.9 mm. The results of the models for the future, forecast a reduction in precipitation of up to 31.13% in the most unfavorable scenario. This decrease will mean ceasing to have an average of 120.45 mm of precipitation per year, which can cause a deficit of water resources at regional level in the long term. On the other hand, the maximum annual daily cumulated precipitation increases in all evaluated periods except in the long term in the most unfavorable scenario where there is more uncertainty. This puts us in front of a scenario of more torrential events in the region of Murcia.

Table 37. Mean and Maximum annual daily cumulated precipitation and related anomalies comparing with the historical. Lighter blue colour implies smaller changes while dark blue implies higher changes.

Scenario and period		Mean annual daily cumulated	Maximum annual daily cumulated
Historical scenario		1.06	35.91
SSP245 scenario	**2023-2039**	1.06	39.20
	2040-2069	0.96	36.92
	2070-2100	0.92	36.90
SSP585 scenario	**2023-2039**	1.02	36.70
	2040-2069	0.90	36.62
	2070-2100	0.73	34.23
Anomaly SSP245 scenario	**2023-2039**	0.00 ⬅	3.29 ⬆
	2040-2069	-0.10 ⬇	1.00 ⬆
	2070-2100	-0.15 ⬇	0.99 ⬆
Anomaly SSP585 scenario	**2023-2039**	-0.04 ⬇	0.79 ⬆
	2040-2069	-0.16 ⬇	0.71 ⬆
	2070-2100	-0.33 ⬇	-1.68 ⬇

Figure 133 presents the results of the evolution of the mean annual daily cumulated precipitation along the period 2015-2100 using downscaled data from eight different climate models for the SSP245 climate scenario. The average value for the eight models under SSP245 is presented in Figure 134 where the confidence interval is represented by the maximum and minimum value of the set of models in each simulation year. The same representation for the mean annual daily cumulated precipitation variation under SSP585 climate scenario is included in Figure 135 and Figure 136 respectively. The results by model have great heterogeneity, which is very visible in the figures for comparing the results of the models, where no clear trend is observed by model evaluating the provided precipitation results.

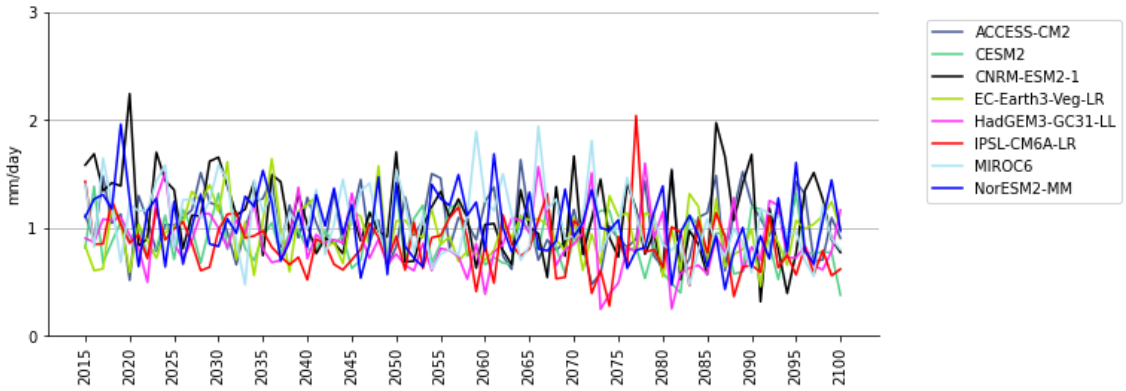


Figure 133. Mean annual daily cumulated precipitation in the SSP245 scenario (2015-2100) for eight models in the region of Murcia obtained by statistical downscaling procedure.

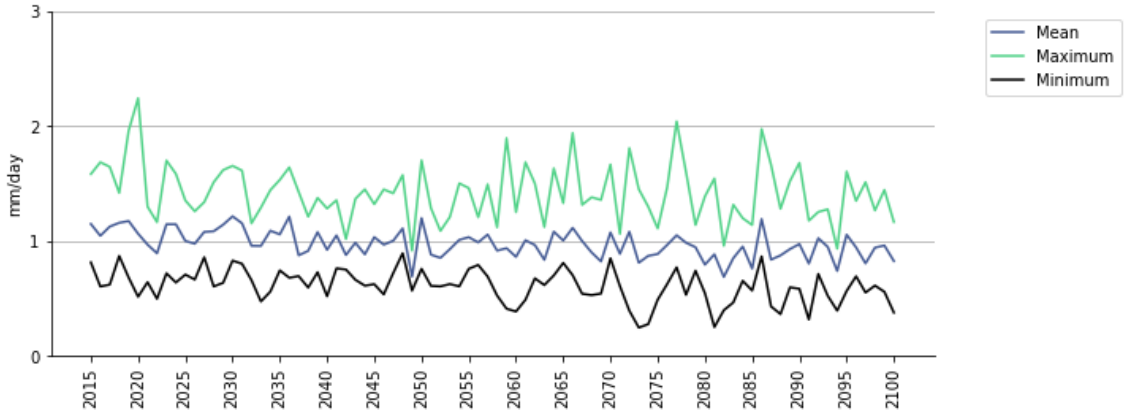


Figure 134. Ensemble mean annual daily cumulated precipitation and range of variation (Maximum and Minimum) for a set of eight models in the SSP245 scenario (2015-2100) for the region of Murcia.

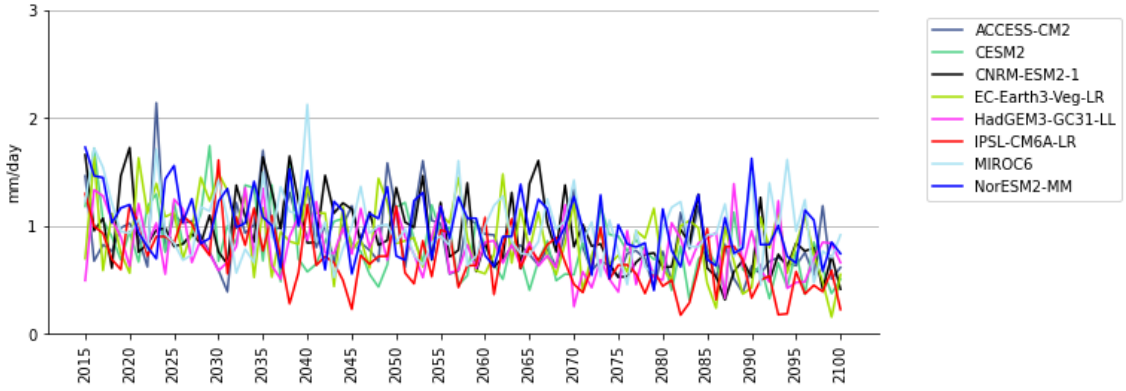


Figure 135. Mean annual daily cumulated precipitation in the SSP585 scenario (2015-2100) for eight models in the region of Murcia obtained by statistical downscaling procedure.

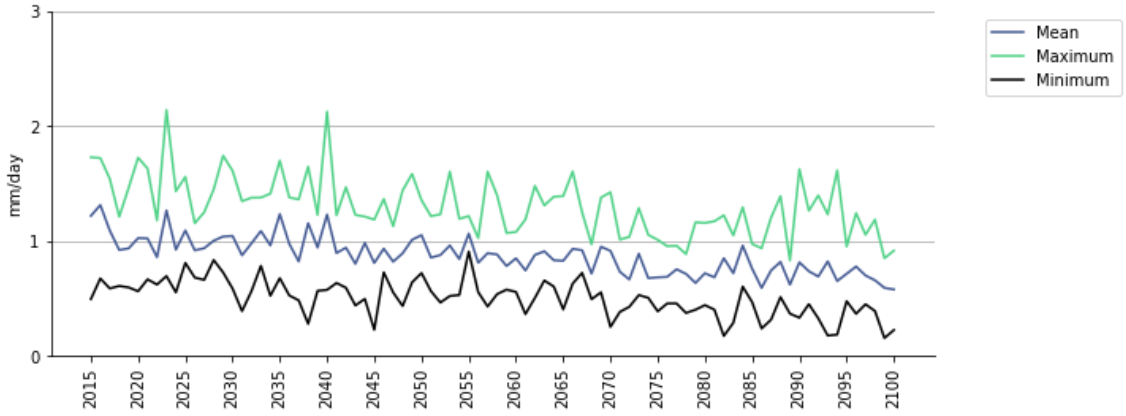


Figure 136. Ensemble mean annual daily cumulated precipitation and range of variation (Maximum and Minimum) for a set of eight models in the SSP585 scenario (2015-2100) for the region of Murcia.

○ Wind

Analyzing the results of the two selected climate scenarios for the future to investigate the evolution of the mean annual daily wind speed in the Region of Murcia, a trend is observed that projects a small decrease in the average wind speed if we compare it with respect to the average value of the historical scenario (Table 38). These changes in wind speed are conditioned by the increase in temperatures, together with the roughness and sealing of the land surface. However, and despite the forecast decrease, the average value will not fall below 3.2 m/s even in the most unfavorable scenario (SSP585).

Table 38. Mean annual daily surface wind speed and related anomalies comparing with the historical. Lighter grey colour implies smaller changes while dark grey implies higher changes.

Scenario and period		Mean annual daily surface wind speed
Historical scenario		3,40
SSP245 scenario	**2023-2039**	3,30
	2040-2069	3,29
	2070-2100	3,27
SSP585 scenario	**2023-2039**	3,33
	2040-2069	3,28
	2070-2100	3,23
Anomaly SSP245 scenario	**2023-2039**	-0,10
	2040-2069	-0,10
	2070-2100	-0,12
Anomaly SSP585 scenario	**2023-2039**	-0,06
	2040-2069	-0,12
	2070-2100	-0,17

Figure 137 presents the results of the evolution of the mean daily wind speed along the period 2015-2100 using downscaled data from six different climate models for the SSP245 climate scenario. The average value for the six models under SSP245 is presented in Figure 138 where the confidence interval is represented by the maximum and minimum value of the set of models in each simulation year. The same representation for the mean annual daily wind speed variation under SSP585 climate scenario is included in Figure 139 and Figure 140 respectively. It is observed in the figures that wind is more or less constant for both scenarios in the future evaluated period.

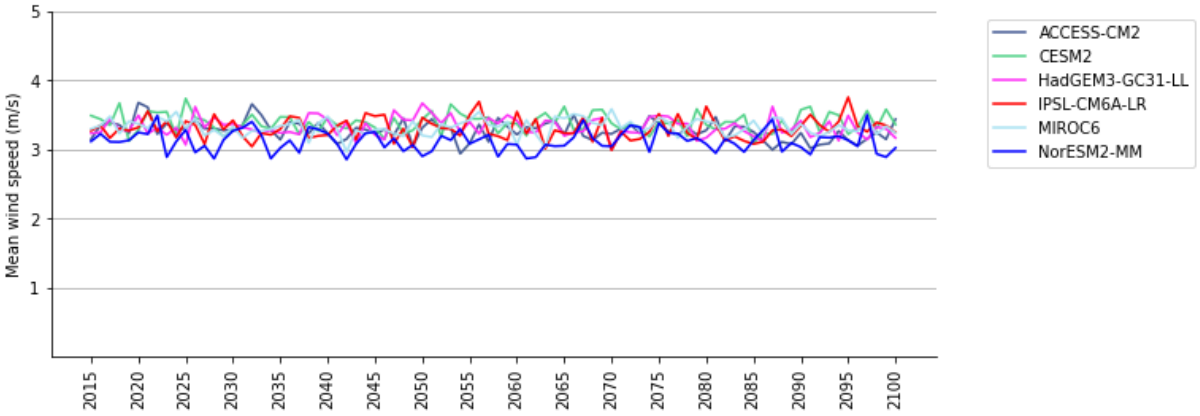


Figure 137. Mean annual daily wind speed in the SSP585 scenario (2015-2100) for six models in the region of Murcia obtained by statistical downscaling procedure.

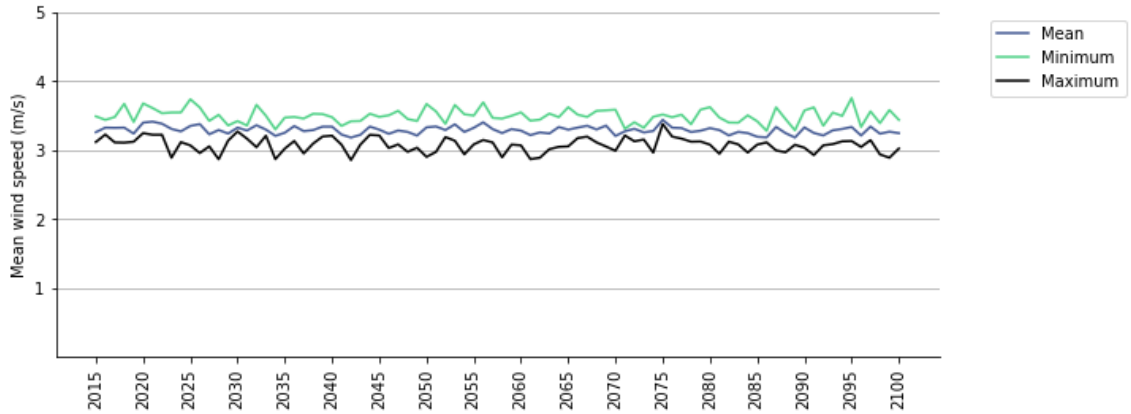


Figure 138. Ensemble mean annual daily wind speed and range of variation (Maximum and Minimum) for a set of six models in the SSP585 scenario (2015-2100) for the region of Murcia.

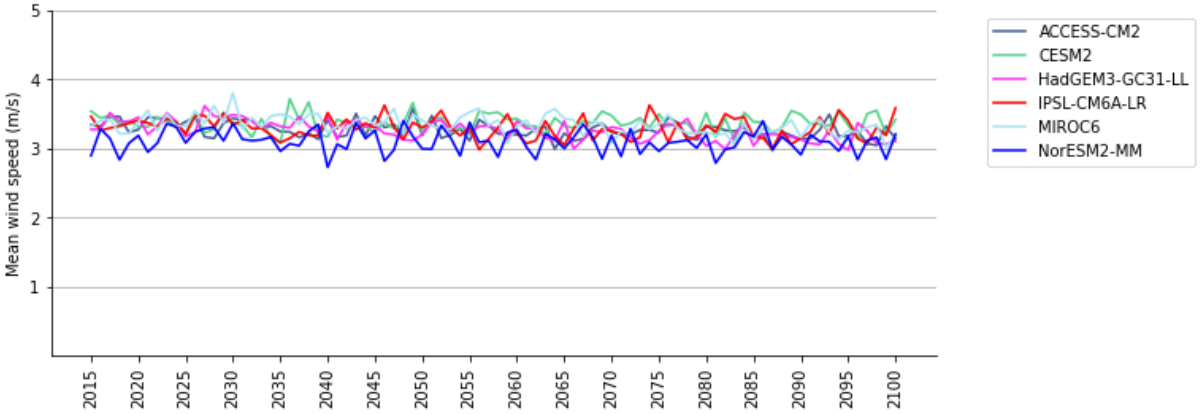


Figure 139. Mean annual daily wind speed in the SSP585 scenario (2015-2100) for six models in the region of Murcia obtained by statistical downscaling procedure.

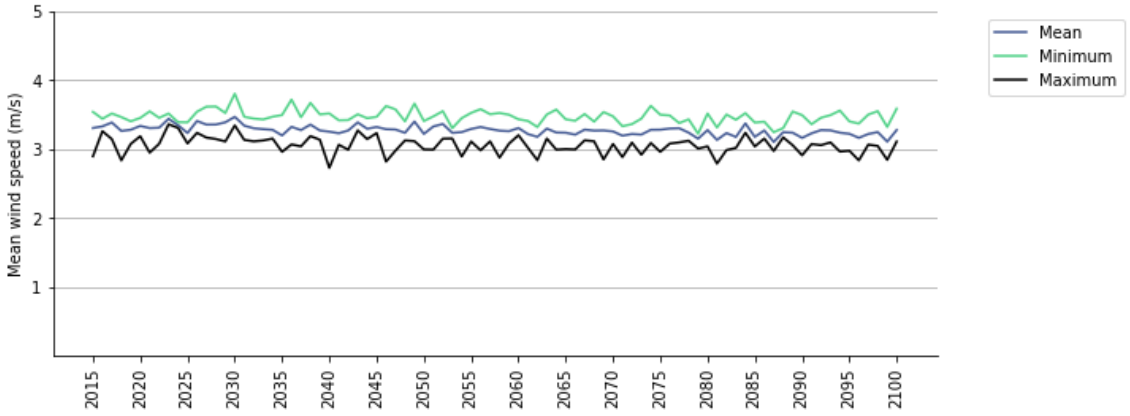


Figure 140. Ensemble mean annual daily wind speed and range of variation (Maximum and Minimum) for a set of six models in the SSP585 scenario (2015-2100) for the region of Murcia.

6.1.1.2. Vulnerable sectors: identification of exposure assets

As introduced in section 2.1.1.2, the key vulnerable NEVERMORE sectors for Murcia case study are agriculture, forest and fishing, and water and waste heritage for the high priority sectors, and with a second priority the sectors of industry and commerce and tourism, leisure and cultural heritage.

This was agreed with case study leaders in the first consultation (internal) as contrast exercise with the challenges and vulnerable sectors reported at proposal stage. The activity consisted on an online Jamboard in which the CS leaders identified their main challenges, to then relate them with the sectors and priorities for them (results can be seen in Figure 141).

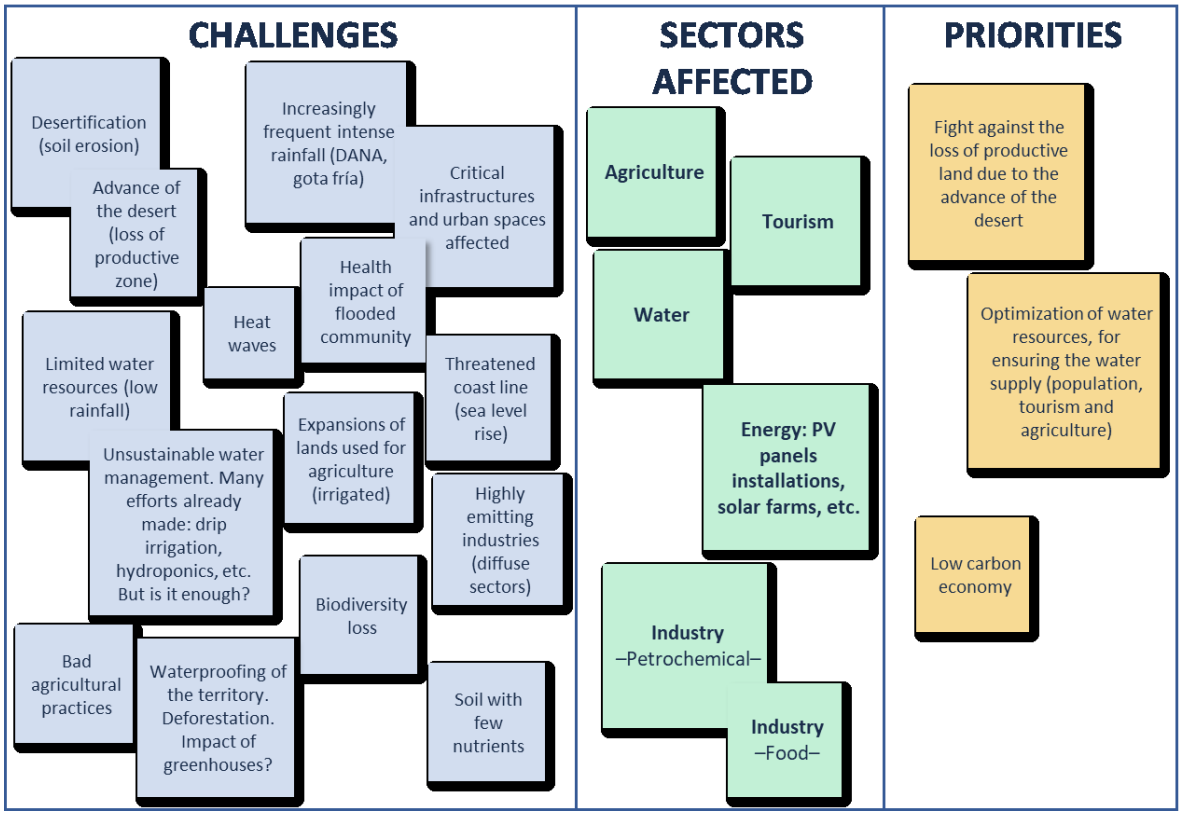


Figure 141. Results of the consultation with Murcia case study leaders on the CS challenges, related sectors affected and priorities

Then, the first consultation with the Local Council of Stakeholders was held, and a similar activity to confirm the selection and heard other voices on this was performed. During this activity (developed the 16th February 2023 in online format) the stakeholders overall recognized and agreed with the challenges previously identified.

○ Agriculture, forestry and fishing

The agriculture, forestry and fishing sector are very important in the Murcia economy being key to understand the social implications that climate change impacts could generate. In terms of surface or covered area in Murcia region, agriculture cover the 50% of the total area, followed by forestry, which reaches 45%, being the artificial part of anthropic activity concentrated in the remaining 5% of the total regional surface (Figure 142). This area distribution is very representative, since we are facing a region in which the primary sector plays a key role in the social and economic sector and also in the management of water resources that are quite limited.

Agriculture as primary sector in the region is quite important, considering their role in the regional economy, the effects of climate conditions and its location on the Mediterranean region under arid conditions with high influence of the Mediterranean Sea. These factors allow fishing and, above all, agriculture to acquire great development, and to stand out from other Spanish regions, due to the volume of production and the productivity of the crops. Murcia has 881,9 km^2 of crop area, being a third part of this area dedicated to agricultural production. The area over the last decade, both for the total and for the more general types of crops, were constant with small variation during the analysed timeline. It therefore implies an economic activity that manages the territory and of which it is necessary to know its different characteristics and the distribution of the different types of crop management (intensive or extensive agriculture, irrigated or rainfed, etc). Figure 143 presents the distribution between different crops types in the last years.

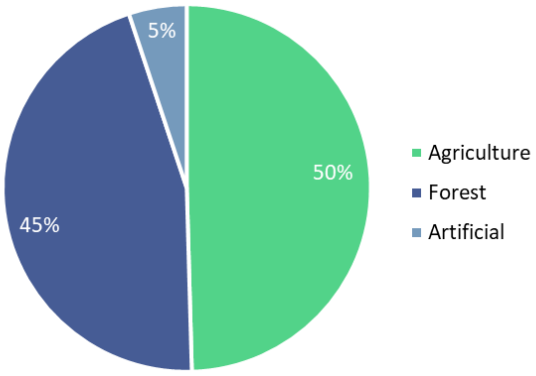


Figure 142. Percentage of area by use. Source: Own elaboration based on IFN4 data.

As it is presented in the Figure 143, the crop area was constant in the last 10 years, while there was an increase in crop production in the region (Figure 144). It is probably due to a more intensive crop management that generates a rotation in crop land use to take advantage of land constantly avoiding periods without management. This intensive management has generated an increase in greenhouse emissions. The evolution of the production of the two main crop types (annual and woody) is presented in Figure 144, covering the period 1975-2020.

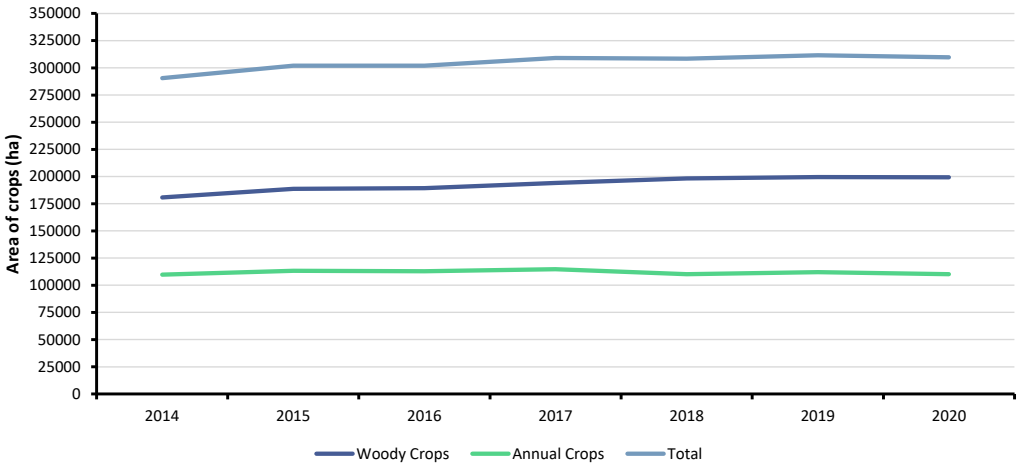


Figure 143. Evolution of the area of different crops. Source: Own elaboration based on INE data and data from the Autonomous Community of the Region of Murcia (CARM).

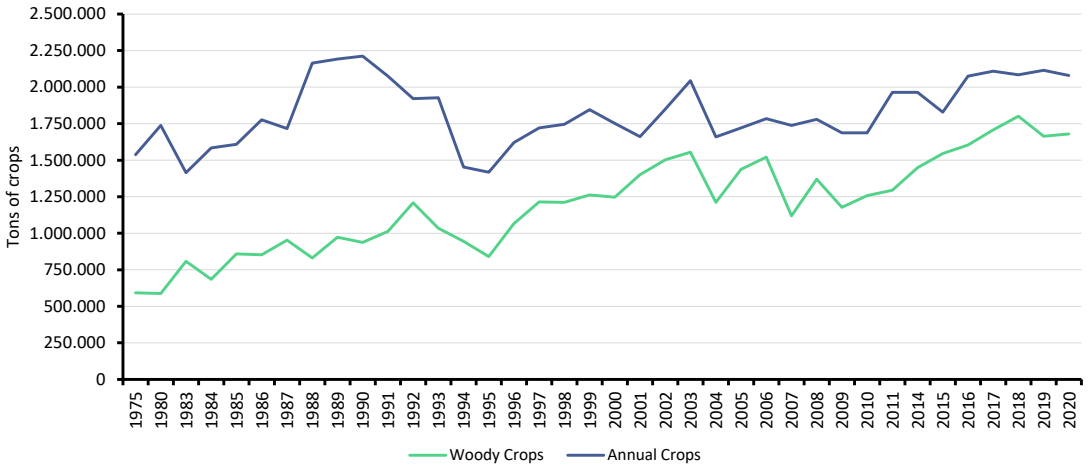


Figure 144. Evolution of the production of different crops. Source: Own elaboration based on INE and CARM data.

Since 1975, agricultural production has fluctuated considerably, although in general terms there has been a positive trend towards the increase of production due to technological improvements in this sector. Woody crops have increased their production more than three times in comparison with the initial tonnes of 1975. The changes in annual crops have been more drastic, and nevertheless, with respect to the general computation, they have undergone less growth in production. Initially, annual crops were three times more productive than the woody ones, nowadays that difference has been reduce. The Region of Murcia has ideal climate conditions for fruit and vegetable production, through improved productivity associated with greater water and energy efficiency. Therefore, the variety of horticultural crops as well as their productivity could be considered high. Figure 145 presents the distribution between different woody crop types in the last 40 years.

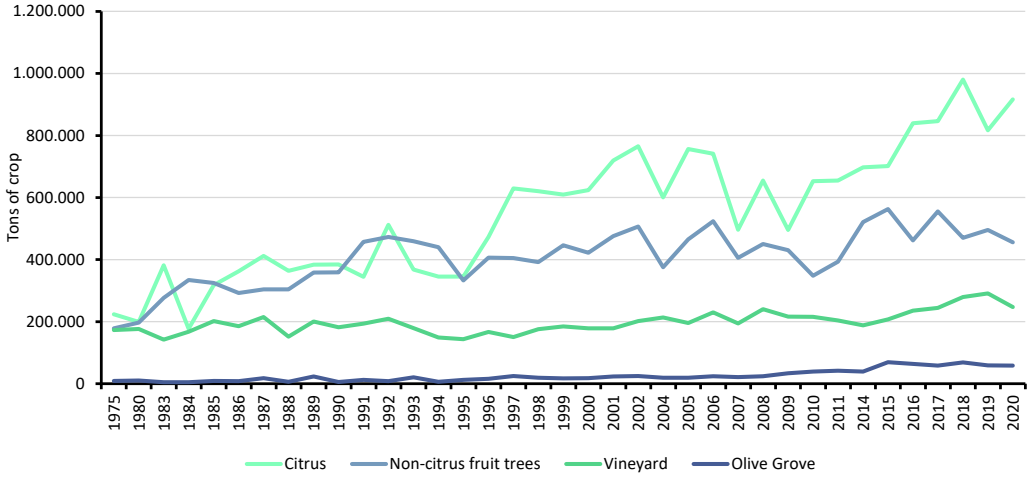


Figure 145. Evolution of the production of different woody crops. Source: Own elaboration based on INE and CARM data.

All woody crops have suffered an increase in their productivity since the 80s, although in different proportions. Fruit is the most widely grown crop and the one that has seen the greatest increase in this region, given its climate and topographical characteristics, which allow it to grow almost all year round. Citrus fruits are the ones with highest production, having quadrupled and almost quintupled their production volume since 1980. Also, it is necessary to reflect the development of two of the woody crops that are more relevant in Mediterranean, the olive tree and the vineyard, which despite the quality of the products derived from them, their production has not undergone major changes. In terms of quality, the region has four Protected Designations of Origin (DOP), one for pears and three associated with wines. Figure 146 presents the distribution between different annual crop types in the last 40 years.

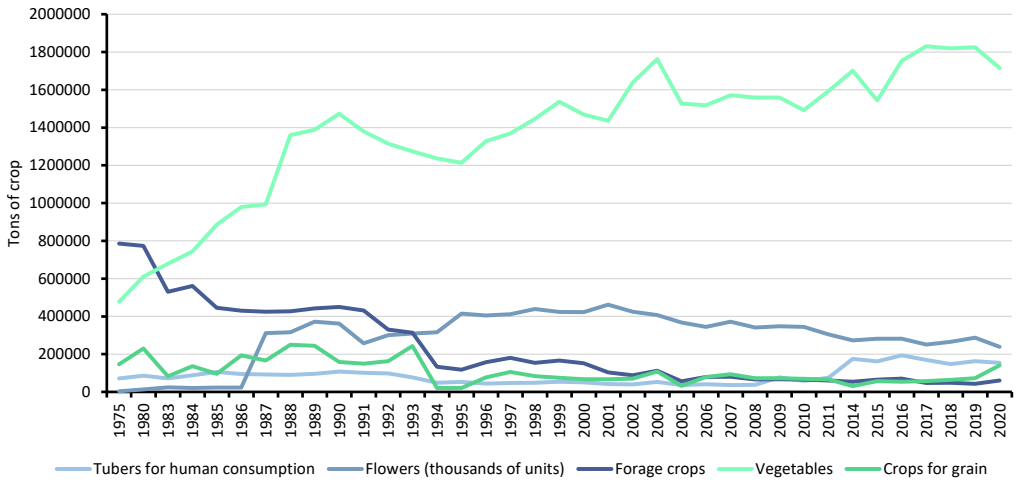


Figure 146. Evolution of the production of different arable crops. Source: Own elaboration based on INE and CARM data.

The annual or herbaceous crops recorded a greater increase in productivity in the region, compared to woody crops. This change is associated with historical events that took place in Spain. There was a big change in the cultivation pattern of herbaceous crops after 1975 and the Spain's entry into the European Union (EU) in 1986. From that decade onwards, Spanish products started to become more competitive and productive, as well as an increase in exports to EU and non-EU countries. The cultivation of forage and grain crops fell to a minimum in contrast to the exponential growth of flower and vegetable crops at the end of the 80s of the 20th century. Vegetables are the most produced crop type in this region, reaching more than 1.8 million tonnes in recent years. In addition, wheat together

with the other grain cereals has seen its harvests almost disappear from being the most produced crop in the region at the end of the 20th century. It is also necessary to highlight the drop-in production of all crops during the periods of economic crisis (1994-1995 and 2008-2014) with significant decreases. Figure 147, presents the evolution of the two main crop types and the total in the period between 2014-2020.

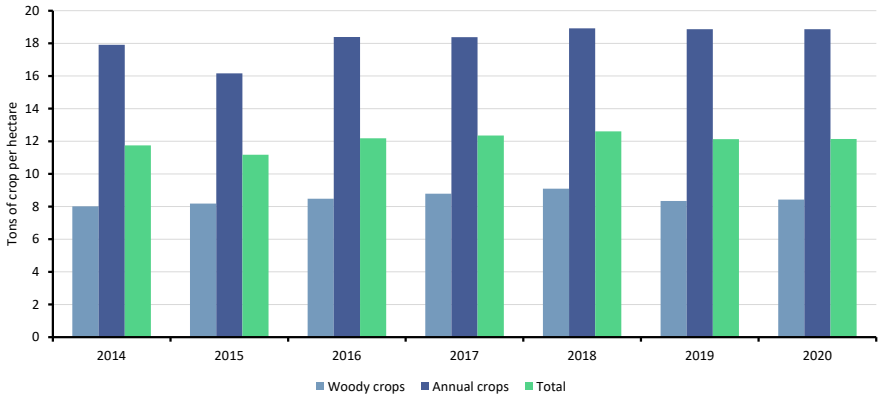


Figure 147. Evolution of the productivity of different crops and total. Source: Own elaboration based on INE and CARM data.

As a result of the average between the different types of crops, the total average productivity for the region is lower than the productivity of annual crops. This is due to the existence of more surface devoted to woody crops with lower production than annuals, which need more space (three times more than herbaceous crops) and results in a low productivity for this type of crop and as consequence, lower overall productivity. In this way, the lower productivity of woody crops in comparison with herbaceous crops in the region is clear.

It is also necessary to evaluate the impact of agriculture and more in general, the impact of all the primary sector in the employment. In this sense, the population employed in the primary sector in Murcia region, at least since 2008 (including agriculture and livestock), represents the 10-15% of the total number of people employed in the whole region. Despite being one of the least representative sectors, it is important to assess its economic impact, considering the subsectors that comprise it, as well as the area required and its productivity, particularly in the case of agriculture. Between the beginning of 2008 and the end of 2014, the average number of people employed in the primary sector increased from 8% to 14%, almost double the share of 2008, starting in the first quarter of 2015. Since 2018, employment is decreasing, reaching 2009 levels, where primary sector employment was around 10%. This employment percentage is presented in Figure 148, covering the period between 2008 and 2022.

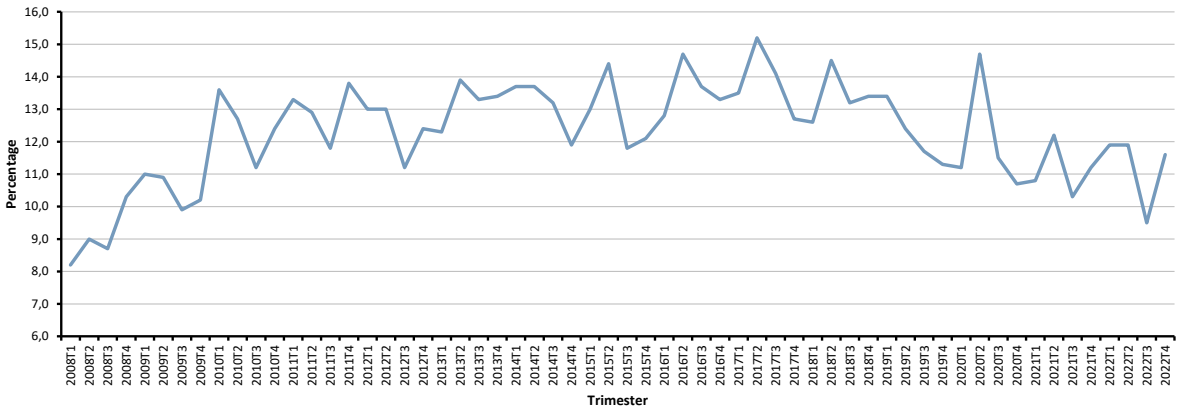


Figure 148. Evolution of the percentage of total employment in the agriculture and livestock sector. Source: Own elaboration based on INE data.

The evolution of livestock sector in the region, is presented in Figure 149. It should be noted that it has not suffered great variations, despite this, it is considered that all types of cattle have a grooving trend or remain stable. Pig farming is the most representative of the region, and since 1997 the number of pigs has exceeded one and a half million, sometimes reaching two million. Sheep are the most stable in terms of the number of heads, being slightly more than 500,000 since 1997. Goats are the most dynamic and have undergone the most drastic variations in population size. Finally, the bovine is the least representative, but the one that has grown proportionally more in the last 20 years, almost doubling its size (from about 50,000 head to almost 100,000 head).

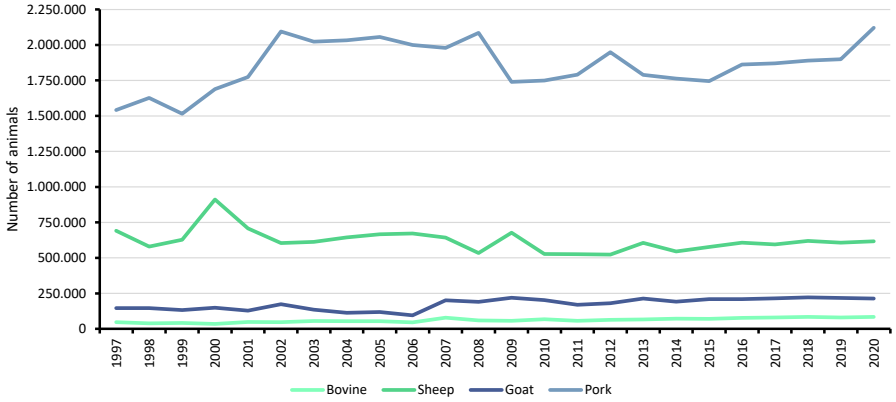


Figure 149. Evolution of the livestock cattle. Source: Own elaboration based on CARM data

In terms of fisheries (Figure 150), there is a large difference in volume and price between the different types of capture fisheries. The volume and market for aquaculture is higher than for sea fishing. Sea fishing is more constant in terms of the quantity of fish in weight extracted, and although there has been some change, the market value has not fluctuated. Between 2016 and 2019 aquaculture represented a stable relationship between the volume of fish and its cost and/or profit, however, after the COVID-19 pandemic, between 2020 and 2021, the price of fish from this type of fishing has increased in value with respect to the relationship that already existed.

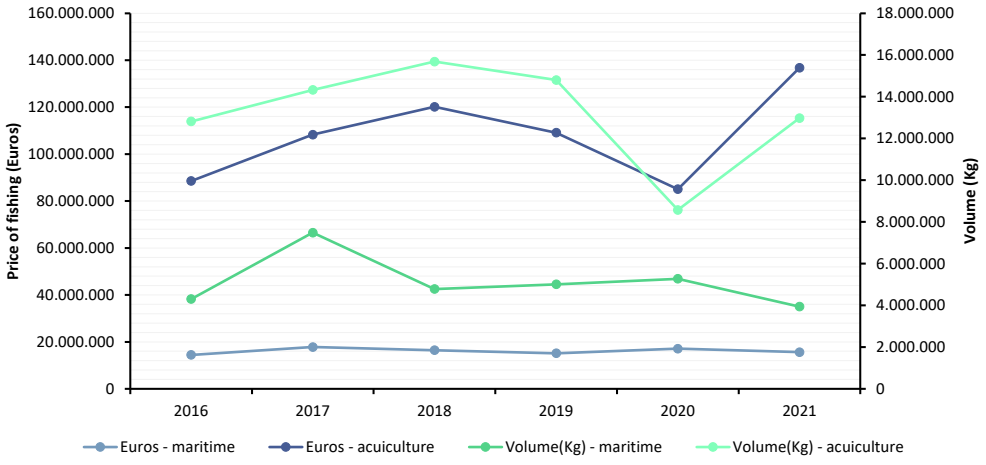


Figure 150. Evolution of the fishing volume and prices. Source: Own elaboration based on CARM data.

The size of the employed population in the fisheries sector is low, and has decreased slightly over the last 20 years (Figure 151). Despite of the changes and fluctuations in the sector, the number of employees in the fisheries sector is still above 500.

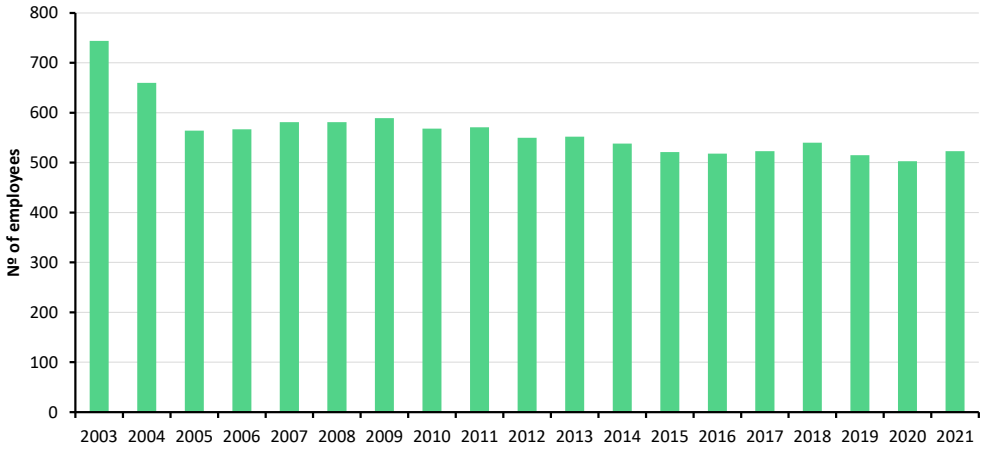


Figure 151. Evolution of the total fishing employment. Source: Own elaboration based on CARM data.

According to the 4th Forest National Inventory of Spain (IFN4, acronym in Spanish), 70% of the forest area in Murcia region corresponds to woodlands with less than 10% of the Forest Cover Fraction (FCC, acronym in Spanish), which includes scrubland, wetlands or scattered woodland. Around 27% of the forest area is covered by conifers, mainly *Pinus* and *Juniperus* species that are adapted to water scarcity and high evapotranspiration conditions. Mixed and broad-leaved forests are poorly represented in the region, since they barely correspond to 10,000 hectares each (around 1% of the region's area).

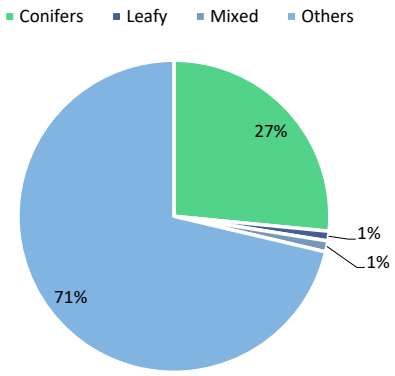


Figure 152. Percentage of area of different types of forest. Source: Own elaboration based on IFN4 data.

○ Water and waste

Water is a key resource in Murcia region, considering the region's arid climate conditions. The lack of water is due to the scarcity of rainfall, as well as the dependence for irrigation on the Tajo-Segura water transfer, in force since the 1980s, and the exploitation of water for the development of the primary sector. Water limitation mainly affects irrigated crops as well as the water access for domestic activities. In addition to the accessibility of water, the quality of the water to which one has access must be assessed. One of the most famous examples is that of the Mar Menor, the largest lagoon in Spain, associated with RAMSAR wetlands, protected natural spaces and areas of special importance for the Mediterranean, as well as other areas protected for their high ecological value, is also in a state of poor quality. This is due to the discharge of water contaminated by different substances associated with economic activities in the area, including fertilizers and pesticides from agriculture. Nowadays, available water comes almost equally from surface and subsurface water, which endangers the status of aquifers, given the volume of water used (Figure 153 and Figure 154). It is important to emphasise that when access to one type of water decreases, the access to the other increases as they

counterbalance each other to maintain access to the same volume of water or at least to cover human and economic needs. However, since 2008 the volume of water available has decreased, being affected as consequence the development of economic activities that requires water and the household water consumption.

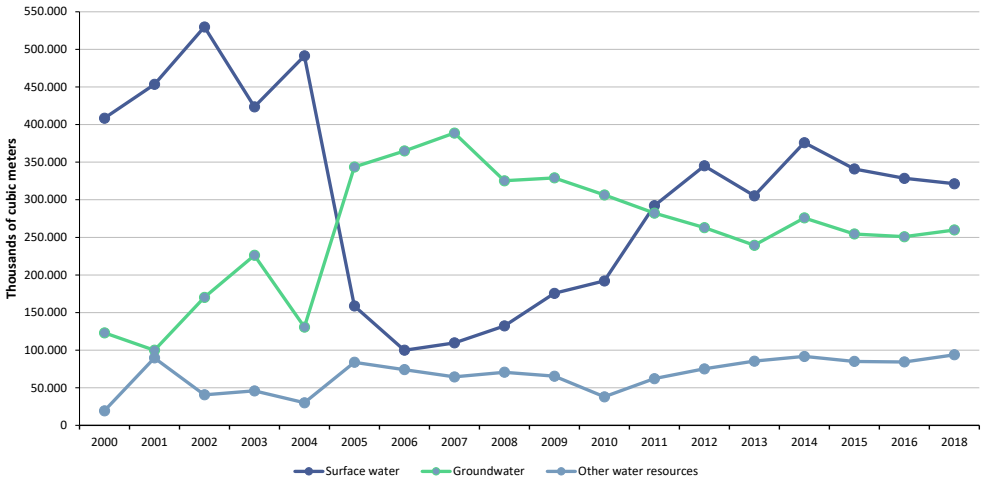


Figure 153. Volume of water available by origin. Source: Own elaboration based on INE data.

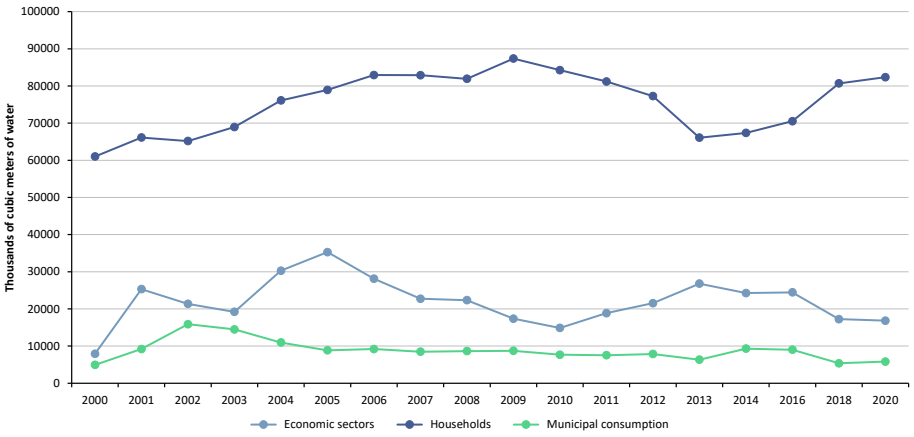


Figure 154. Volume of water by user. Source: Own elaboration based on INE data

It is important to highlight that the 80% of the water supplied is for households or domestic consumption, being the only use that maintains the volume of required water, covering the needs with available water that comes from aquifers. It also occurs during periods of water stress or worse weather conditions in which water availability is very reduced.

Related to water availability, water consumption, water stress and climate conditions, it is necessary to consider the price of water for supply, but also for consumption and treatment. The first two costs are more expensive in the region of Murcia than the Spanish average, as water for domestic consumption in Murcia costs a 25% more than the average, and the cost of supply in general in Murcia region is 50% more than the average. However, the cost of water treatment is similar between Murcia and the national average. In general terms, at national and regional level, the cost of access to water increased, being twice or three time higher in cost in the recent years, due to drought climate conditions related with climate change, the high use of surface and groundwater resources or the water pollution, conditions that are all affecting but not at the same rate.

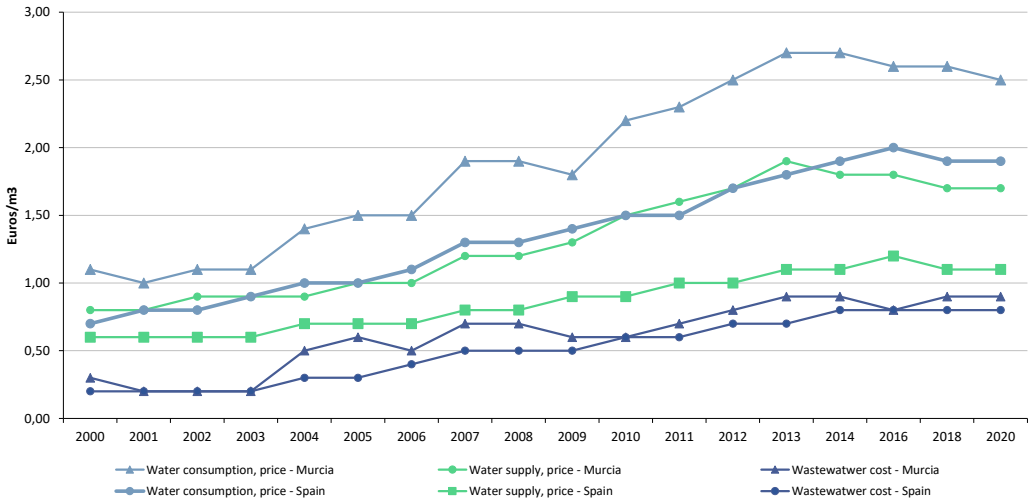


Figure 155. Cost of water by volume consumed, supplied and wastewater in Murcia and national average. Source: Own elaboration based on INE data

Due to the climate conditions, the population size and the trends of the Water Stress Index (WSI) (Figure 155), it is important to take care of the water resources and its quality, and make a good management of water by means of well-defined strategies including good practices to improve water security. The WSI shows the volume of water that is available per person over the course of a year, and the Table 39 shows the categories established for this WSI according to various authors (Damkjaer & Taylor, 2017).

Table 39. Categorisation of WSI.

Category	Contemporary WSI threshold (m^3 capita−1 year−1)
No stress	>1700
Water scarcity	1700 >1000
Water stress	1000-500
Absolute water stress	<500

Figure 156. Water Stress Index (m^3/capita^{-1}/year^{-1}) in Murcia and national average. Source: Own elaboration based on INE data

Murcia and the national average of the index follow a similar trend, although they changed positions after the period 2006-2009, where they had almost identical values. The WSI indicates that Spain is under absolute water stress, maintaining a stable trend around 400 m^3capita^{-1}yr^{-1} since 2005. Murcia

followed the same trend between 2005 and 2010, after which it increased to about $m^3capita^{-1}yr^{-1}$, which it has maintained until 2018, slightly improving its water situation. This causes water to have a heavier weight as a vulnerable sector in this region, and nationally.

○ Industry and commerce

Industry and commerce are two of the main components of the economy of the Region of Murcia. Both, they play an important role in promoting economic growth, employment generation, innovation, and overall progress. The two sectors are interconnected, mutually reinforcing and facilitating economic activity, thus improving the standard of living of the population.

Commerce is associated with the export of agricultural products such as fruits and vegetables, as well as the income generated from tourism activities. However, climate change generates a significant challenge to the economic and commercial development of the Region, as changes in temperature and precipitation patterns are causing a shift in the growing seasons, leading the reduction in crop yields. In addition, changing water and thermal conditions are hampering the region's tourism industry, with changes in visitor destinations possibly driven by extreme temperatures or a scarcity of water resources.

The role of industry and commerce in the economic growth, employment generation, and innovation makes them significant contributors to the Gross Domestic Product (GDP) of the Region of Murcia as well as at country level. In this sense, the GDP represents the total value of all goods and services produced within that region or country during a given period. In general, a higher GDP indicates a more robust and healthy economy. Industry produces goods and services that are sold in the market, while commerce distributes, markets, and sells those goods and services. Together, these two sectors create jobs, generate income, and drive innovation, which in turn leads to economic growth that can be analysed thanks to the GDP growth. To evaluate the economic status, the GDP per capita of the region of Murcia has been calculated and compared with the national average of Spain (Figure 157), in order to have a comparison of the development and economic inequalities respect to the National level.

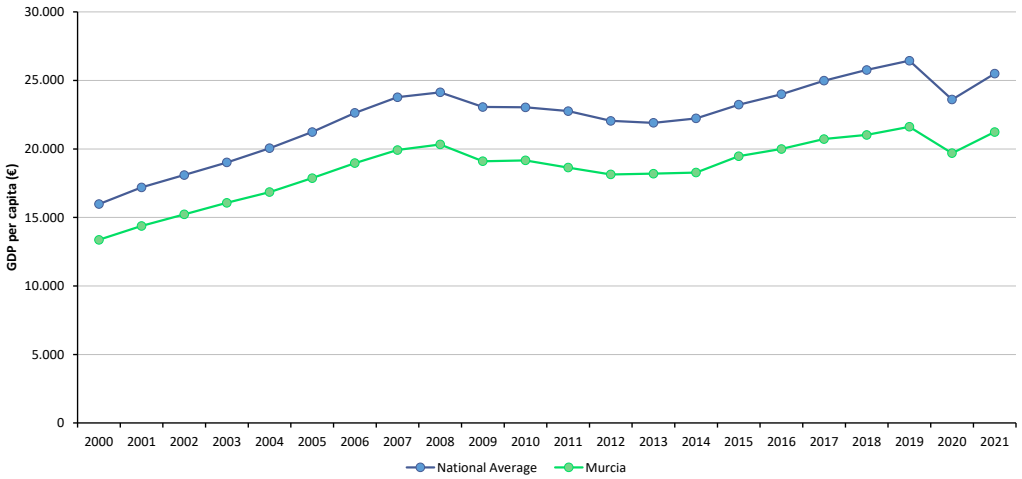


Figure 157. GDP per capita in Murcia and national average. Source: Own elaboration based on INE data.

Since 2000, the GDP per capita has increased, with a slight decline between 2008 and 2015, associated with the economic crisis, as well as in 2020 due to the effects of the COVID-19 pandemic. After these economic and health crises, the positive trend in GDP continues. The GDP in the Region of Murcia is between 15.5% and 18.5% lower than the National average of Spain. The increasing trend in the GDP, indicates an improvement of the economic conditions, which would allow a better development of the Region thanks to higher disposable income per capita.

The evaluation of the contribution of the industrial sector to the economy includes the Industrial Production Index (IPI) and the employment rates. The IPI is a metric used to measure changes in the output of industrial sectors over time and provides an indication of the sector's growth or reduction. Employment rates provide insight into the labour force participation of the industrial sector.

When analysing the IPI, it is essential to consider the seasonality of industrial development. Seasonality refers to the fluctuations in output that occurs during certain times of the year due to natural factors such as weather or holidays. In the case of the Region of Murcia, fluctuations and associated effects occurs during summer (July-August) and Christmas (December-January) holidays.

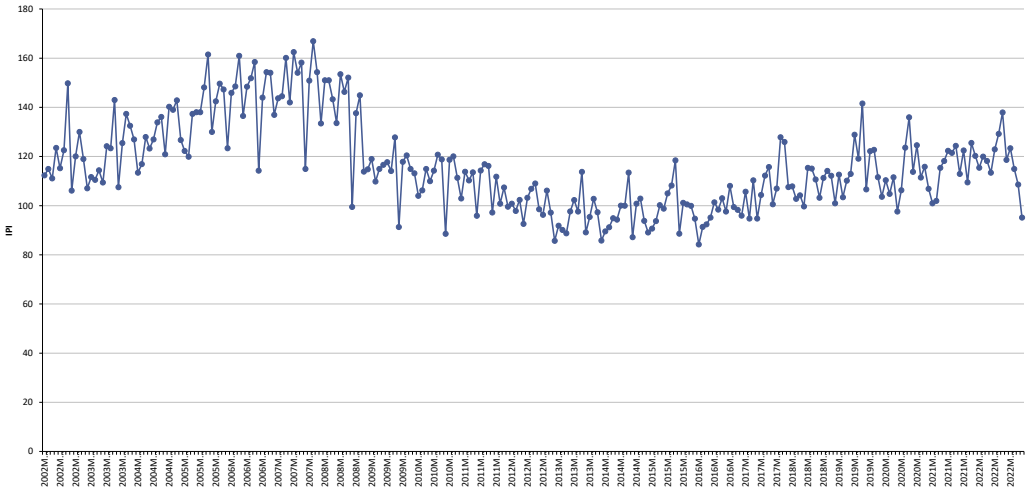


Figure 158. Industrial Production Index (IPI) in Murcia by trimester. Source: Own elaboration based on INE data.

The Industrial Production Index (IPI) (Figure 158) has been experiencing a negative trend since mid-2008, which is a significant shift from the previous trend where it was increasing. This trend can be attributed to various factors such as the global financial crisis of 2008, which resulted in a decrease of the demand for goods and services, leading to a decline in industrial production. Between 2012 and 2016, the IPI reached its minimum value, with an annual average of 95-100. Despite the COVID-19 pandemic and the associated economic crisis, the IPI has shown signs of improvement, with a positive trend in industrial growth. This trend can be attributed to several factors, such as the implementation of economic measures by governments to boost the industrial production, increased demand for industrial goods and services due to changing consumer preferences, and the adoption of sustainable practices in the industrial sector.

As a result of these factors, the IPI has been increasing steadily and has reached levels last seen in 2002 by 2022. This positive trend indicates that the industrial sector is recovered from the effects of the economic crisis and is contributing to the overall economic growth of the Region. To ensures growth and sustainability in the industrial sector, it is essential to continue monitoring the IPI and associated industrial development in the next years.

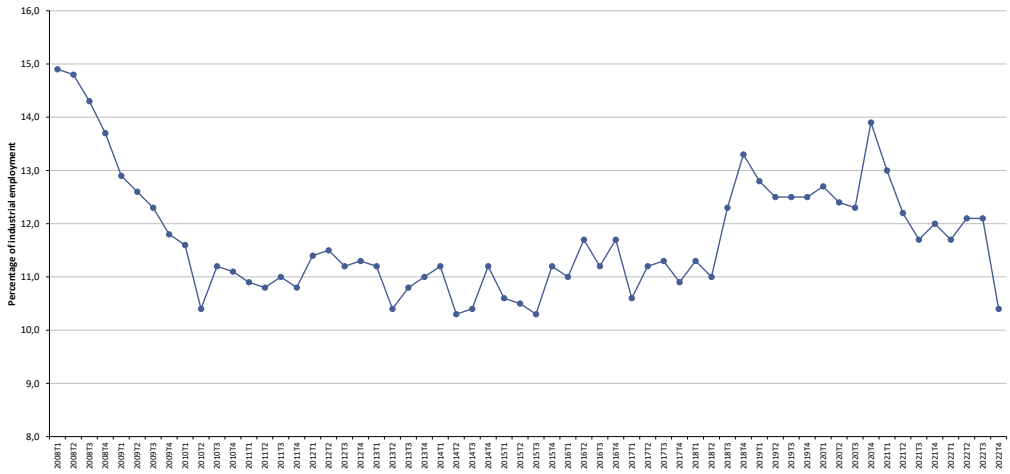


Figure 159. Percentage of industrial employment in Murcia by trimester. Source: Own elaboration based on INE data.

Following the onset of the economic crisis in 2007-2008, the employment rate in the industrial sector experienced a reduction of the 5%, and it remained between 10-12% until 2018. However, it began to show a growth trend from 2018, which was disrupted by the COVID-19 pandemic. The employment rate in the industrial sector has a high-degree of seasonality, with a recurring pattern of decline during the first quarter of each year. Between 2010 and 2017, the annual employment rate in the industrial sector was relatively stable, but between 2008-2010, it experienced a decline of 4%. It is also necessary to highlight that the employment rate in the industrial sector was recovered between 2018-2020, reaching pre-crisis levels in 2008. However, it experienced a decline again due to the COVID-19 pandemic, albeit to a lesser extent than during the previous economic crisis.

Industry and commerce are crucial components of the economy in the Region of Murcia. They have a close interlinkage, and together they promote economic growth, employment generation and innovation. However, the effects of climate change are a significant challenge to the Region affecting economic and commercial development, and also crop yields and tourism. However, the positive trends in GDP, IPI, and employment rates indicate the recover and good development of the industrial sector in the Region of Murcia. In this sense, continuous monitoring and sustainable practices are crucial for ensure a continuous growth and the economic sustainability of the Region.

○ Tourism, leisure and cultural heritage

Tourism is a key economic activity in the Mediterranean region, due to the great potential to attract visitors thanks to warm climate, the coast and the location. However, climate change and water scarcity are two issues that could significantly affect the tourism in this region. Temperature increase and sea level rise may affect the quality of beaches and reduce the availability of fresh water, which could limit the region resources to meet tourism demand. In addition, water scarcity may limit the availability of water and the region's ability to offer tourism services related with water.

It is important to point out that tourism development must be sustainable and responsible in order to minimise negative impacts on the environment and the local communities, especially in the context of climate change and water scarcity. Therefore, emphasis has been placed on the development of leisure and education initiatives to attract tourists interested in sustainable activities such as cultural, ecological or gastronomic tourism.

The tourism is classified into two categories according to the origin of tourists: domestic and international tourism. This differentiation generates variations in tourists' volumes, duration of stay, and expenditure patterns. Specifically, domestic tourism refers to travel and recreation undertaken by residents within their own country, while international tourism involves the movement of visitors

across national borders for leisure or business purposes. These categories are distinguished based on factors such as the origin of tourists, travel behaviour, and economic impact on the destination. Considering the domestic tourism, the region has data on expenditures and duration of stays in both per capita and aggregate values. The evolution of overnight stays and total money spent by national tourism is presented in Figure 160.

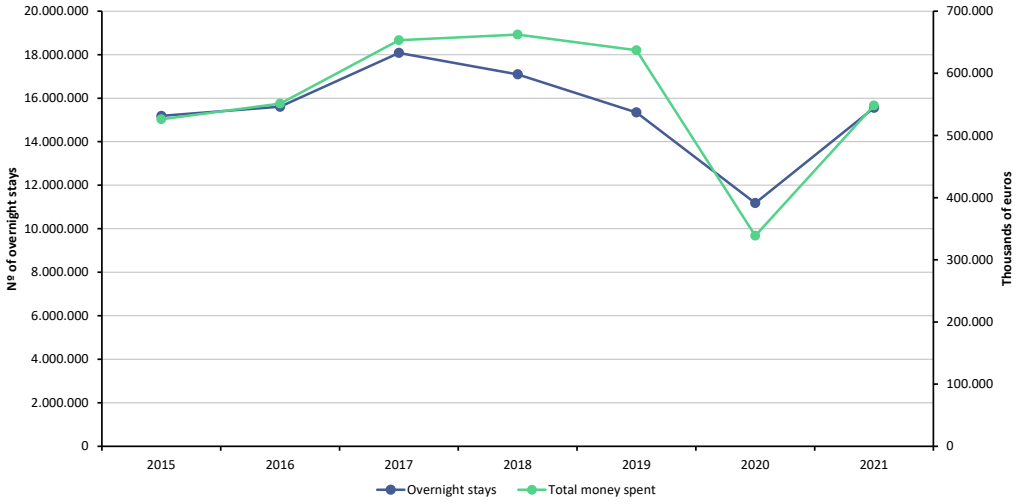


Figure 160. Evolution of the overnight stays and total money spent by national tourism in Murcia region. Source: Own elaboration based on INE or CARM data.

In the evaluated period (2015-2021), national tourists contributed over 15 million overnight stays in the Region of Murcia. However, due to the effects of COVID-19 pandemic, the number of stays was reduced by 3 million in 2020 due to mobility restrictions. In 2021, the expenditure levels have returned to pre-pandemic levels. Interesting is the effect between 2017 and 2019, where the tourists spent fewer nights in the region and the expenditure per day/night remained stable, indicating that tourists spent more money in tourism activities during this period. Figure 161 presents the number of days spent by tourist in the Regions and the average money spent per tourist.

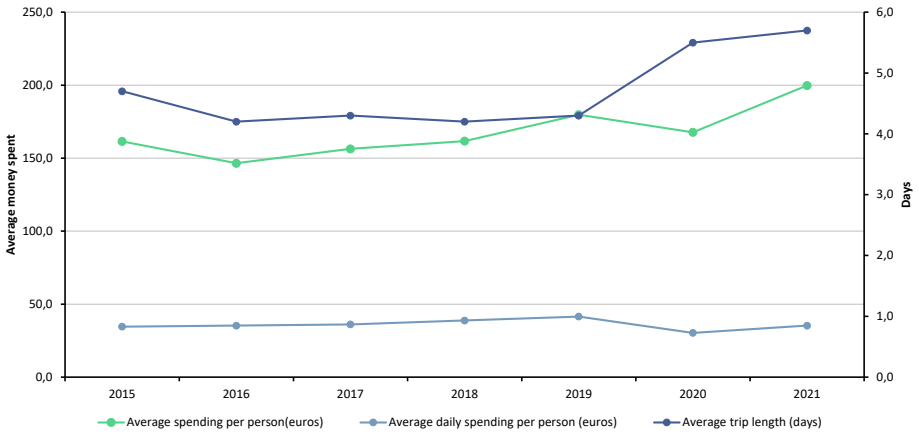


Figure 161. Evolution of the average trip length and money spent per person by national tourism. Source: Own elaboration based on INE or CARM data.

A deeper analysis of the data shows that the increase in average spending per person between 2015-2019 was due to an increase in the number of high-end tourists visiting the Region, who spent more on accommodation, dining and tourism activities. The COVID-19 pandemic caused a shift towards budget tourism as people sought more affordable options during 2020. However, in 2021, the high-

end tourism in the Region was recovered, leading an increase in average spending per person. This was accompanied by an increase in the number of days that tourists spent in the Region of Murcia, indicating that visitors were more willing to spend more time and money on their trips. In addition, the recovery of tourism in the Region has not only surpassed pre-pandemic values, but has also exceeded the National average in terms of number of visitors and expenditure. This suggests that the Region of Murcia is becoming an increasingly attractive tourist destination, and is likely to continue the growth in the coming years.

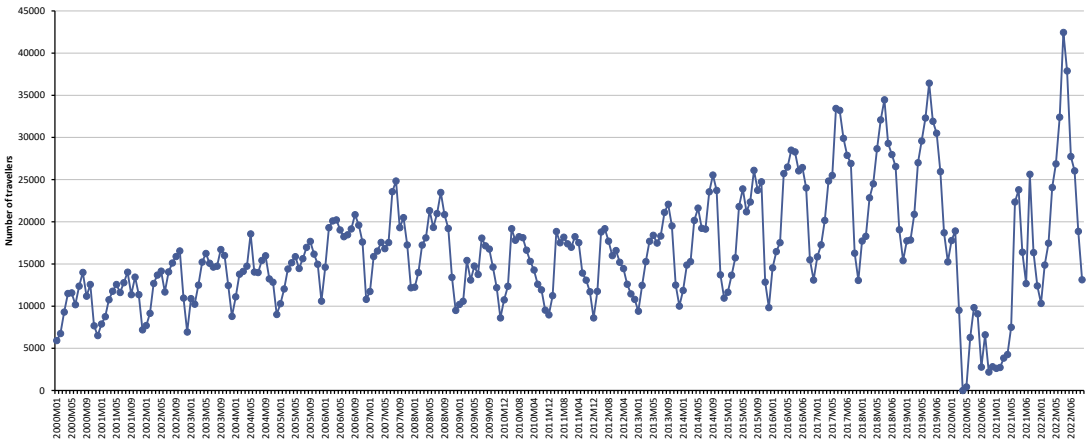


Figure 162. **Evolution of total of international travellers. Source: Own elaboration based on INE or CARM data.**

The Region of Murcia has seasonal pattern in its international tourism, with a concentration of tourist activity during the summer months when temperatures reach their peak values. This trend can be attributed to the warmest climate conditions in the Region, which make it an attractive destination for tourists seeking for warm weather and leisure activities.

Analysing the historical data from 2000 to 2008, it was found a positive overall trend in international tourism, marked by a consistent increase in the number of tourists throughout the year. The 2008-2012 period was significant challenges for the tourism in the Region of Murcia due to the global economic crisis. During this period, the number of international tourists visiting the Region experienced a decline. The economic downturn in the period, coupled with reduced disposable income and a general sense of uncertainty, resulted in a decrease in travel and tourism activity.

Nevertheless, the tourism sector in the Region of Murcia had a gradual recovery trajectory returning to pre-crisis levels of tourism in 2014, increasing its interest as tourism destination and multiplying by two the number of tourists from 2014 in 2019. However, the year 2020 presented an unprecedented setback for international tourism worldwide due to the outbreak of the COVID-19 pandemic. The travel restrictions, border closures, and health concerns led to a significant decline in international tourist arrivals in Murcia, as in the global trend. The Region faced an important decrease in visitor numbers, resulting in an impact on the local economy and tourism-dependent businesses.

Despite the adverse circumstances, there were signs of a slight recovery in international tourism towards the end of 2021. And from April 2022 onwards, the tourism in the Region witnessed a noteworthy resurgence, surpassing the previous trend and indicating a robust recovery. The rebound can be attributed to a combination of factors, including the management of the pandemic, effective marketing strategies, and the Region's inherent appeal as a tourist destination. The improvement in international tourism figures in the Region of Murcia from 2022 brought much-needed relief to the local economy, the labour market, and tourism-related businesses. The total spent by international tourism is presented in Figure 163.

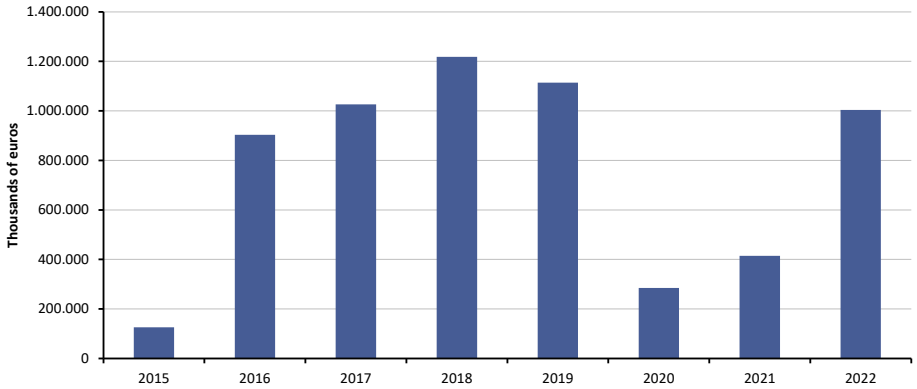


Figure 163. Evolution of the total money spent by international tourism. Source: Own elaboration based on INE or CARM data.

International tourist spending in the Region of Murcia typically reaches around one million euros and follows an upward trajectory affected by the COVID-19 pandemic. It caused a significant disruption to the tourism sector, leading to a decline in tourist spending during 2020 and 2021. This decline was over the 70%, reflecting the impact of the pandemic and the global measures implemented to control the effects. Travel restrictions, border closures, and quarantine requirements severely limited international travel and tourism activity. Nevertheless, signs of recovery emerged in 2021 as travel restrictions eased and vaccination campaigns gained momentum. This modest improvement indicated a gradual return of international tourists to the region and the resumption of economic activity in the tourism sector. As the year progressed, there was a noticeable rebound in tourist spending, contributing to the stabilization and recovery of the tourism economy. By 2022, tourist expenditures returned to pre-pandemic levels similar to 2017. The recovery can be attributed to factors such as the reduction of travel restrictions, increase of consumer confidence and the effective marketing campaigns that attracted international visitors back to Murcia.

As has been seen throughout the description of the sector, the values for tourism in the Region have recovered and returned to pre-pandemic levels. However, it must be considered that it is a seasonal sector that can be greatly affected by the impacts of climate change and its derivatives, mainly affecting the seasonality of tourism.

6.1.2. Climate change factors analysis: adaptation and mitigation baseline

This section presents a review of CO_2 emissions and the stock of carbon stored in the soil and vegetation in the Region of Murcia. The Region of Murcia has available information on CO_2 emissions for the period 2000-2020 following the categories defined by the National Greenhouse Gas Emissions Inventory Report (developed by the Spanish Ministry for Ecological Transition and Demographic Challenge), according to the guidelines set out in the IPCC established in the 2006 IPCC Guidelines (IPCC, 2006) (Table 40). In this sense, the evaluation of emissions has been carried out for each sector of activity in the Region considering. The level of emissions and removals in the Region plays an important role in defining a baseline of the current state and thus being able to propose strategies and solutions that allow the implementation of adaptation and mitigation measures.

Table 40. Main activities considered in the evaluation of CO_2 emissions.

General Activity	Sub-categories of each activity	Specific activity
Energy processing	Combustion activities	Energy Sector Industries
		Manufacturing and construction industries
		Transport
		Other Sectors

General Activity	Sub-categories of each activity	Specific activity
		Other
	Fugitive emissions from fuels	Solid fuels
		Oil and natural gas
Industrial Processes	Mineral Products	-
	Chemical industry	-
	Metallurgical production	-
	Non-energy products and solvent use	-
	Electronics industry	-
	Use of GHG substitutes	-
	Production and use of other products	-
	Other	-
Agriculture	Enteric fermentation	-
	Manure management	-
	Rice cultivation	-
	Agricultural soils	-
	Planned burning of savannahs	-
	Field burning of agricultural residues	-
	Limestone amendments	-
	Urea fertilisation	-
	Carbon fertiliser application	-
LU change & forestry	-	-
Waste treatment and disposal	Landfilling	-
	Biological treatment of solid waste	-
	Incineration of waste	-
	Waste water treatment	-
	Other	-
Other	-	-

It is necessary to highlight that a key category is a priority category in the National Inventory because it has a strong influence in the country's total greenhouse gas emissions inventory in terms of the absolute level, trend, or uncertainty of emissions and removals. Considering this, only the categories with significant emissions in the Region of Murcia were represented in Figure 164.

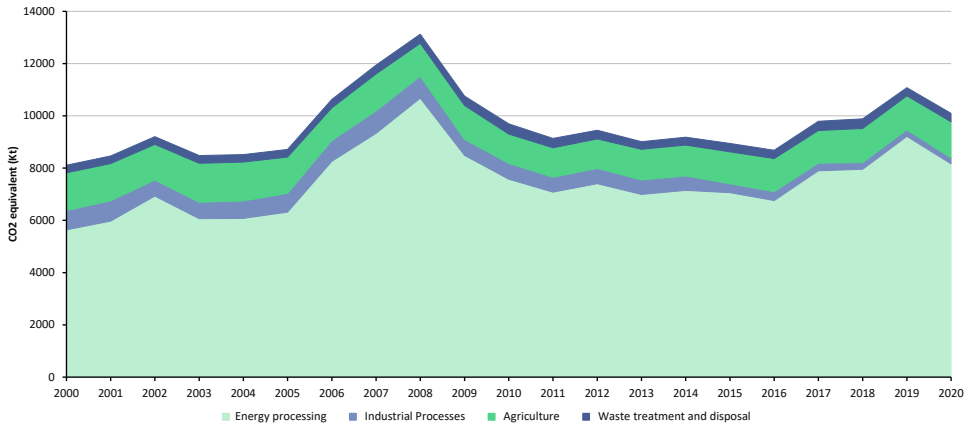


Figure 164. Evolution of the CO_2 eq/yr per category.

Energy processing stands out as the largest contributor to CO_2 emissions in the region, as it encompasses a wide range of human activities. Approximately the 80% of the total emissions can be attributed to this category. It is also necessary to highlight the agriculture with also a significant role in terms of CO_2 emissions, contributing approximately 10-15% of the total emissions. Emissions from

agriculture are linked to various activities such as livestock farming, fertilizer use, and agricultural waste management. By categories, Figure 165, represent the evolution of emissions in the subcategory of energy processing in the assessment period.

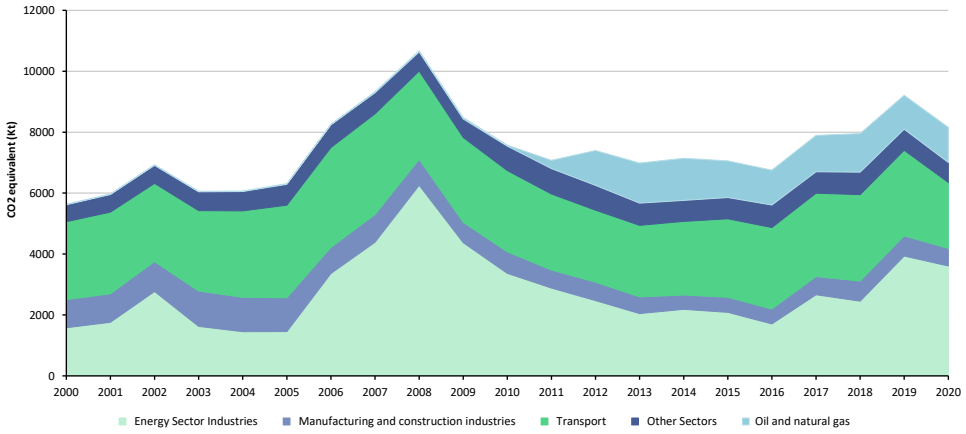


Figure 165. Evolution of the CO_2 eq/yr emissions per subcategory of energy processing.

Considering the energy processing activities, the majority of CO_2 emissions are attributed to combustion activities. However, starting from 2011, emissions from oil and natural gas, have a significant role in the emissions. It is necessary to highlight that the energy sector and the transport industries are the primary contributors to emissions, accounting approximately the 40-50% of the total emissions in the Region. Other activities such as the manufacturing and construction industries join "other sectors" involving combustion and energy processing activities, in which commercial and institutional, residential, and agricultural, forestry, and fishing sectors are involved, also have constant emission levels in the evaluated period. Figure 166 represent the evolution of emissions in the subcategory of industrial processes in the assessment period.

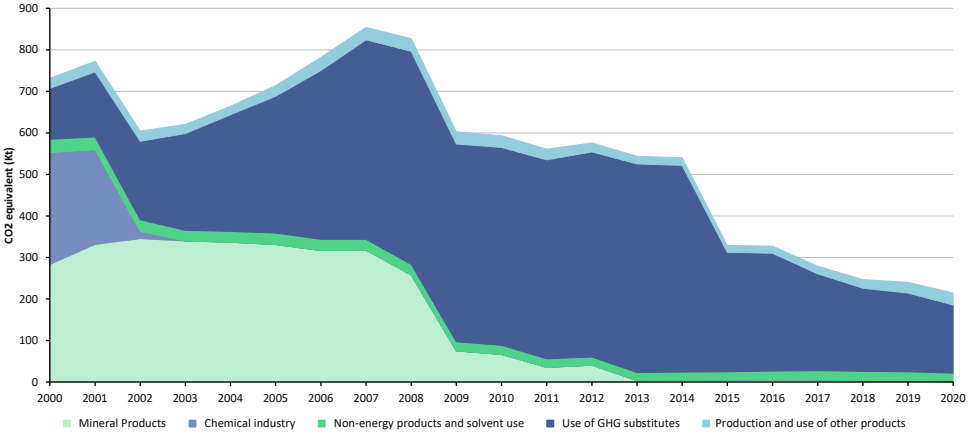


Figure 166. Evolution of the CO_2 eq/yr emissions per subcategory of industrial processes.

Industrial processes had a decreasing trend throughout the evaluated period, led by the use of GHG substitutes as the main CO_2 emitter. Initially, the extraction of mineral products stood out as the largest emitter within the industrial sector. However, with the onset of the economic crisis in 2007, this activity experienced a significant exponential decrease and ultimately ceased to exist in 2013. The chemical industry followed a similar trend, but approximately a decade earlier the emissions had already been eliminated. Emissions associated to obtain non-energy products, the use of solvents, and the production and utilization of other products are reduced in comparison with the use of GHG substitutes. Despite their relatively low emissions, it is important to monitor and manage these

activities to ensure their sustainability and mitigate any potential environmental impacts. After that, Figure 167, represent the evolution of emissions in the subcategory of agriculture in the assessment period (2000-2020).

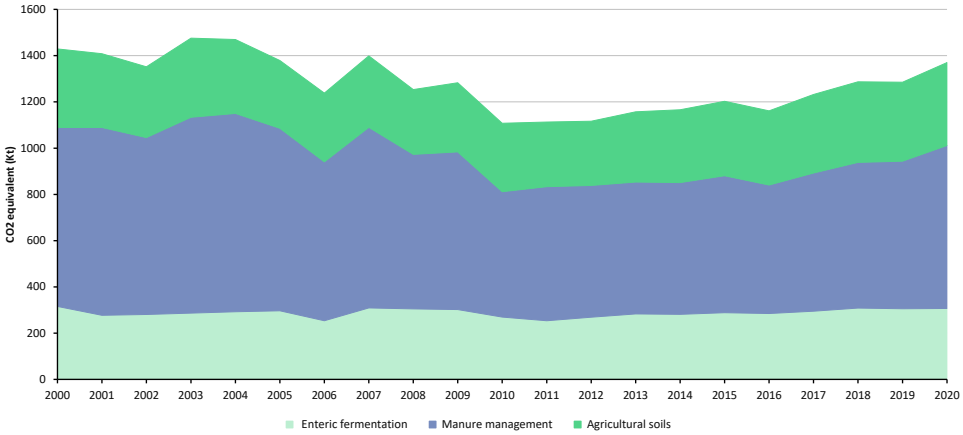


Figure 167. Evolution of the CO_2 eq/yr emissions per subcategory of agriculture.

The agricultural sector plays a high-contributing emissions role in the Region of Murcia. It is the second sector in emission levels. The emissions in these sectors primarily stem from activities associated with manure management, specifically the application of fertilizers to enhance land productivity and crop yield. In addition, the enteric fermentation and agricultural soils, also have consistent emission patterns between 2000 and 2013, with emissions and average around 300 kt of CO_2 equivalent. With a decrease in emissions towards the year 2010, emissions have once again increased significantly in recent years. Finally, Figure 168, represent the evolution of emissions in the subcategory of waste treatment and disposal in the assessment period (2000-2020).

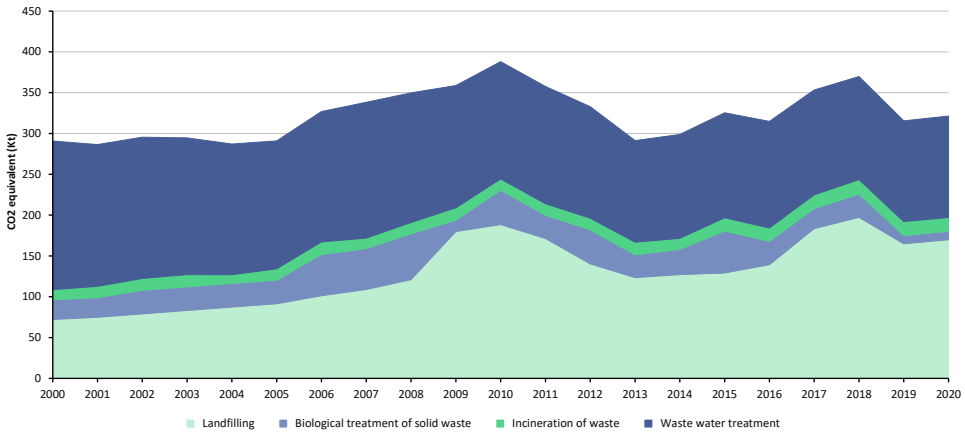


Figure 168. Evolution of the CO_2 eq/yr emissions per subcategory of waste treatment and disposal.

The waste treatment and disposal activities share a similar emissions level with the industrial processes. Over the period of 2000 to 2020, the emissions of this subcategory vary reaching its maximum values in 2010 and 2018 guided by the trend of incineration and wastewater treatment. In this sense, incineration of waste, is the higher emitter in this subcategory with more on less the 50% of the total emissions followed by wastewater treatment. The other categories are responsible of a less amount of emissions if compared with the two higher emitters.

To complement the emissions analysis, the carbon stock in vegetation and soil is provided (Figure 169) using geolocated data from ESA Biomass Climate Change Initiative[54] and Global Soil Organic Carbon Map (from FAO)[55], on soil organic carbon and biomass stock that were translated in carbon stock using default values provided by the IPCC. As a result, the carbon stock in soils is higher the 542,025 $MgCO_2$, while the carbon stock in the biomass increases to 2,426,766 $MgCO_2$. The evolution of carbon stock in biomass along the years with available data is represented in Figure 170. It is observed how the carbon stock in the biomass has been increased since 2010 reaching values higher than 2.4 million in 2020.

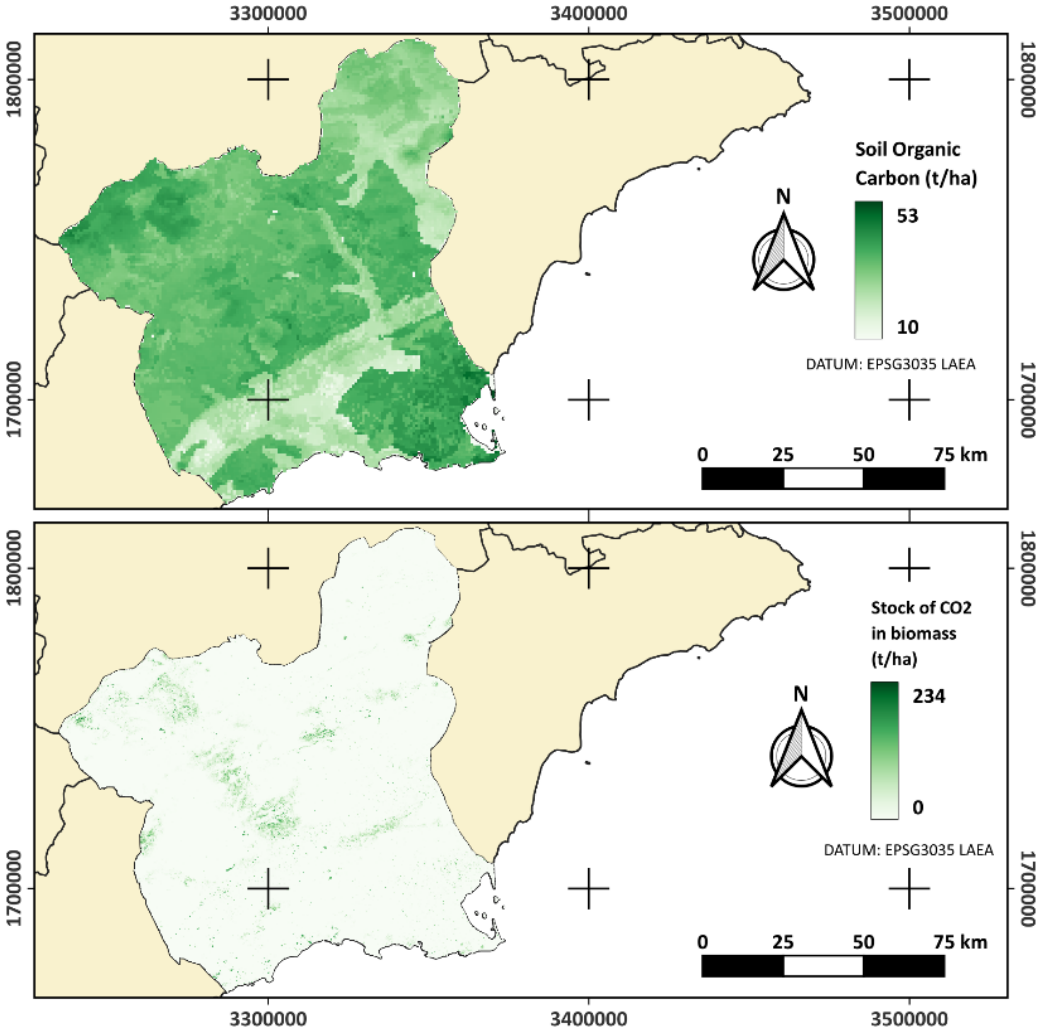


Figure 169. Carbon stock (tCO_2) in soils (top) and carbon stock (tCO_2) in biomass for the Region of Murcia in the reference year. Source: Own calculation based on ESA Biomass Climate Change Initiative and Global Soil Organic Carbon Map (from FAO) data respectively.

[54] https://data.ceda.ac.uk/neodc/esacci/biomass/data/agb/maps/v4.0
[55] https://data.apps.fao.org/glosis/?share=f-6756da2a-5c1d-4ac9-9b94-297d1f105e83&lang=en

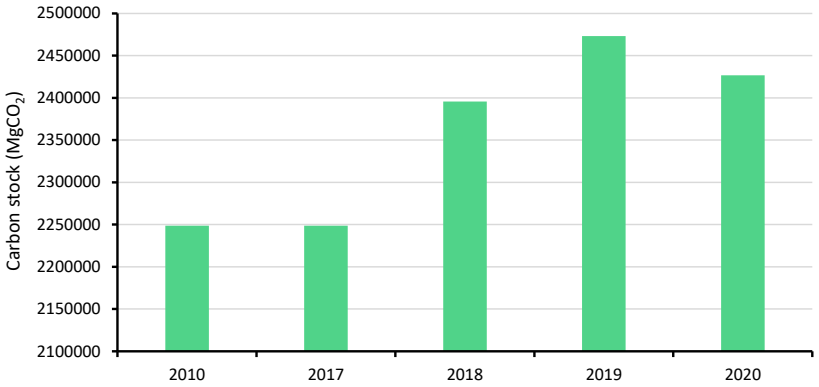


Figure 170. Carbon stock in biomass ($MgCO_2$) for the Region of Murcia between 2010 and 2020. Source: Own calculation based on Global Soil Organic Carbon Map (from FAO) data.

6.1.3. Past experience and legal framework analysis

For the past experience and legal framework analysis of Murcia Case Study, 21 documents were identified and high-level characterised within key fields. From them, 8 were selected as the most relevant and interesting ones, and were further analysed.

The detailed information of this analysis can be consulted in Annex 4 in section 11.7. The following Table 41 includes the relation of those documents analysed deeply and few key aspects on them. This legal framework will help to define the starting point for policy implementation considering the most important sectors and the associated climate change impacts.

Table 41. Relevant documents analysed for CS4 Murcia Region

#	Name of the document	Type	Scope	Year	Main sectors
1	**Climate Change in the Region of Murcia: from the Paris Agreement to the climate emergency**	Roadmap	Regional	2021	• Agriculture, forestry and fishing • Water and waste • Biodiversity and natural heritage
2	**Strategy for Mitigation and Adaptation to Climate Change in the Region of Murcia**	Strategy	Regional	2019	• Society • Water and waste • Energy • Biodiversity and natural heritage • Transport
13	**Integrated National Plan for Energy and Climate 2021-2030 (NECP)**	Plan	National	2020	• Energy
14	**National Plan for Adaptation to Climate Change (NAP) 2021-2030**	Plan	National	2021	• Waste and waste • Biodiversity and natural heritage • Agriculture, forestry and fishing • Tourism, cultural heritage • Energy • Transport • Industry and commerce
15	**Energy Plan for the Region of Murcia 2016-2020**	Plan	Regional	2016	• Energy

16	**Special Civil Protection Plan against the Risk of Flooding in the Autonomous Community of the Region of Murcia**	Plan	Sectoral	2007	• Water and waste
17	**Emergency Civil Protection Plan for Forest Fires in the Region of Murcia**	Plan	Sectoral	2021	• Agriculture, forestry and fishing
19	**Strategic Plan for the Agrifood Sector of the Region of Murcia**	Plan	Sectoral & Regional	2007	• Agriculture, forestry and fishing • Industry and commerce

6.2. PESTLE results for the local ecosystem drivers' analysis

This section discusses how the impact of climate change, and adaptation and mitigation policy implementation are affecting the Murcia region based on political, economic, social, technological, environmental and legal factors. Table 42 below provides details of the key items collected for each PESTLE factor. The sources for the information provided in the table are from the data collection results which came from the different exercises with stakeholders, the case study leader and supporter to identify the main drivers and the data sources to understand the local ecosystem (reported in section 11.8 Annex 8. Case Study 4 – Mediterranean Region (Murcia): PESTLE results for the local ecosystem drivers' analysis). The process to complete this PESTLE was explained in the methodological part of this document (section 2.2).

Table 42. Results from Murcia PESTLE analysis.

Factors	Category	Details	Impact status
Political	Governmental policy	Urban Plan ▪ Regional Strategy on mitigation and adaptation to climate change ▪ Urban Agenda 2030 ▪ Sustainable Master Plan of Villa de Fuente Álamo Master Plan	Positive
	Tax Policy	Green taxation policy ▪ Local policies promoting ecotourism	Negative
	Environmental policy	Life Adaptate measures ▪ Political context in favour of carrying out actions aimed at fighting climate change	Positive
	Funding grant/initiatives	Regional incentives to buy electric cars or install PV panels ▪ Economic incentives for industry to calculate the CO_2 and water footprint ▪ Sustainability voucher: external service to calculate and get the ISO certificate ▪ FEDER incentives of the central state administration: EDUSI for climate resilience actions ▪ Initiatives that promote healthy living, for example zero-emission transport	Positive
Economical	Economic growth	Active promotion of local green employment in the region ▪ Robust primary sector and local companies to boost the economy	Positive
	Economic investment	Powerful business ecosystem and high investment in PV solar energy, both in large plants and self-consumption	Positive
	Financing capabilities	Emission trading of diffuse sectors and industries	Positive
	Disposable income	Relevant disposable income level	Positive
Social	Population	Population growth due to labour migration ▪ Ageing population	Negative
	Health	Awareness on climate change	Positive
	Trends	Sustainable tourism, sustainable transport and energy efficiency ▪ Public awareness ▪ Fight against forest fires and pollution of aquifers ▪ Employment and training program for "Auxiliary activities in forest conservation and improvement"	Positive
	NGOs	SOS Mar Menor ▪ Hippocampus association for the sea conservation in Murcia	Positive
	Climate change	Public Authorities, city Council, local institutions promoting actions against climate change	Positive
Technological	Production	Water management techniques: hydroponics, drip irrigation	Positive

Factors	Category	Details	Impact status
	Training	ADAPTECCA website ▪ Energy data and relevant information on climate change ▪ Avoid the use of nitrates in agriculture ▪ Network of technology centers and universities ▪ Local actors on R&I	Positive
	Potential investment	Strong industry in efficient water irrigation ▪ Scarce participation of actors from the region in calls related to technology, R&D from the EU ▪ ICT solutions at local level (for example, 5G networks)	Positive
	Cost and tax	Circular economy initiatives ▪ Action plans promoting technological research	Neutral
Environmental	Emissions	Covenant of Mayors for Climate and Energy ▪ Bike lanes ▪ PV panels ▪ Public lighting LED (efficient)	Positive
	Sustainability	Ojos Naturalized Viewpoint Project for Nature-based Solutions implementation ▪ Enhancement of the Natural area of Majal de Gracia and a green lung in the Old speed circuit of Fuente Álamo ▪ Ecological green corridors ▪ Clean the Segura river (2000)	Positive
	Positive business	Biogas plant construction ▪ Biomass use promotion ▪ Desalination plants, for human consumption and for agriculture	Neutral
	Carbon footprint	Circular economy activities ▪ Urban gardens	Positive
	Adaptation	Urban areas shadowing ▪ Reduce the overexploitation of aquifers ▪ Vulnerability to DANA events	Positive
Legal	Renewables legislation	Regional Strategy for Mitigation and Adaptation to Climate Change ▪ Order of June 28, 2021, to achieve climate neutrality in the business sphere ▪ Business Plan for Climate and Energy	Positive
	Health and safety	Reuse of grey water, reinjection after debugging ▪ Legislation regulating rural housing ▪ Climate Emergency Declaration approved on June 4, 2020 ▪ Regional Park of the salts and falts of San Pedro del Pinatar	Positive
	Equal opportunities	Municipal equality plan ▪ Gender equality and non-discrimination	Positive
	Environmental legislation	Environmental impact declarations ▪ Law on Integrated Environmental Protection ▪ Law for protected areas ▪ Action plan of the Mar Menor	Positive

If we consider the **political factors**, we can see the relevance of plans and strategies as factors that help to stimulate the adoption of measures to reduce the impact of climate change through the reduction of emissions and the improvement of adaptation to climate change. Initiatives and incentives to promote renewables can also be key to contribute to the sustainability of the region, its resilience and decarbonization. Green taxation could be a problem limiting the economic activity. Considering the perception of the population about the politicians and the policy status of the region, the 37.2% has the perception of a good or very-good situation being the higher value since 2019. Citizens (45.6%) have the idea of the political situation will be the same in the next years while the 28.3% of the citizens thinks that the situation will get worse[56].

If we analyze the **economic factors**, investment in industry and in the improvement of business models, can serve to guide the population's capacity to become climate aware and advance in the decarbonization of the region's economy through the improvement in the use of resources. It must be considered that the GDP per capita in 2021 was 21,236 €, highlighting its increase of 7.8% compared to the previous year. However, its value in 2021 had not yet recovered the values prior to the pandemic caused by COVID-19 (21,617 €). The regional GDP value is significantly lower than the national average (25,498 €), which may be indicative of the need for incentives for the population to implement measures or invest money in training and environmental awareness so that the population becomes aware of climate change.

Social factors in the region of Murcia are influenced by the population, its evolution and the equality aspects. The population has increased slightly in recent years, reaching 1,531,878 inhabitants in 2022

[56] https://www.cemopmurcia.es/wp-content/uploads/2022/07/BAROMETRO-PRIMAVERA-22.-WEB.pdf

(1st of January), which represents an increase of 0.8% compared to 2021. Its distribution between men and women is equitable (50%). This increase is due to migration rates that cause population fluctuations to be conditioned by the population demand required in the agricultural sector. Just over 13% of the population in the region is a foreign population. For the region, the Gini coefficient ranges between 0.24 and 0.34 depending on the municipality, which gives us an idea that incomes are not very different among the population. The promotion of actions in the region is guided by NGOs and local authorities that enable training campaigns to improve the population's awareness of the reality of climate change.

Technological factors consider the role of technology as a driver to guide adaptation and mitigation against climate change. Murcia region has three universities and several technology centers that guide the research, development and innovation activities in the region. With great interest in saving and efficiency in the use of water, its activities train the population to become aware of the use of a resource that is very limited in the region and on which much of its economic activity depends. Climate information and climate change viewers, such as AdapteCCa[57], can help to create that change in citizens behavior by anticipating the effects of climate change and the reduction in the available water resources. Murcia region allocated 1,623.15 Million € for education in 2020 being the 81% of this budget allocated to university education. This is a clear indicator on the commitment of the region with education since it represents the 3% of education investment at national level.

Regarding **environmental factors**, initiatives at different scales to reduce greenhouse gas emissions stand out, as well as to improve and efficiency in the use of energy. There are several projects implemented in the region that seek to improve its sustainability or even, its adaptation to climate change. This gives us information about the interest and commitment of regional and local administrations in following the guidelines established at the European level. Being a region with serious water problems, the commitment to sustainability is essential as a mean to ensure the survival of the ecosystem services of its territory and to avoid the loss and degradation of vulnerable areas such as the Mar Menor or the improvement in the use or resources as the water. More efforts are necessary to raise awareness among the population about the scarcity of water resources, in order to reduce its consumption (150 l/inhabitant·day versus 133 l/inhabitant·day at national level).

Finally, **legal factors** must be analyzed, directly related to the legislative framework and regulations to improve the adaptation or use of resources. We must highlight the initiatives to protect both the environment and energy, or the fight against social inequalities (being the 26,3% of the population considered at risk poverty in 2022 that was lower than in 2021 (27,7%)) and gender parity. Above all, we must highlight the relevance of adaptation and mitigation strategies, that are key to ensure the region's climate neutrality and its resilience.

6.3. Summary of case study characterization in Murcia Region

The Region of Murcia is the third largest exporter of fresh fruits and vegetables in Spain. It has semi-arid subtropical Mediterranean climate. This means that the thermal amplitude between seasons stands out, with hot summers and mild winters, and climatic differences between the coast and the interior areas. Rainfall is scarce and irregular, and concentrated in Autumn and Spring, lately appearing in torrential forms, leading to floods and torrential events.

According to the climate and weather analysis under historical conditions and the projection to a future period, the mean annual daily temperature will increase (around 4.9 ºC according to the most unfavourable scenario, being higher than 20 ºC by 2100). The precipitation in the future, will slightly decrease according to the data from climate models, with a reduction of 31% in the total precipitation according to the most unfavourable scenario. On the other hand, the maximum annual daily cumulated

[57] https://adaptecca.es/

precipitation increases in all evaluated periods, which could be translated in torrential events as was previously mentioned.

Altogether, this climate tendency will affect in a negative way the most vulnerable sectors in the Region of Murcia, which were identified by the case study leaders and supporters, together with local stakeholders. These are: agriculture, water (scarcity), industry and commerce (as per their relation to agriculture sector), and tourism, as a seasonal sector part of the Mediterranean potential to attract visitors.

The agriculture, forestry and fishing sector will be highly affected by climate change, and it is important also to understand the social implications that it will produce. The agriculture covers the 50% of the total area, while forest covers the 45%, which means that the remaining 5% is where the anthropic activity is concentrated. In the last years the type of crops has changed as result of different factors, which has an effect of the average total productivity of the region -lower overall. Consequently, it has also a high impact in the employment, not only in the primary sector, but also related to the subsectors that it comprises.

The lack of water due to the scarcity of rainfall in the Region, as well as the dependence for irrigation of the Tajo-Segura rivers, which will be highly affected by climate change will generate higher risk and vulnerabilities. Water limitation affects irrigated crops and water access for domestic activities, without forgetting the quality of it, that must be assessed as well, since it is affected by the different substances related to the economic activities in the area, mainly fertilizers and pesticides from agriculture.

In the same line, industry and commerce are also relevant in the Region of Murcia, both interrelated and in relation with the agriculture production, so they will be affected by climate change impacts at a proportion as the agriculture and other related activities will be.

Finally, tourism is a key economic activity in the Mediterranean region, due to the potential to attract visitors thanks to the coast location and warm climate. Thus, climate change and water scarcity are issues that will affect it, as per the temperature increase and sea level rise consequences in tourism flow.

The adaptation and mitigation baseline have been analysed as well, outlining that energy activities are the largest contributor to CO_2 emissions in the region, encompassing a wide range of human activities and around 80% of the total emissions. Agriculture has also a significant role in the emissions, as well as industrial activities, waste treatment and disposal activities. It is also worth mention the carbon stock potential of vegetation and soil, which increased the last years.

As per the past experiences in the Murcia Region, a total of 21 documents were analysed at high-level, and eight from them were further analysed due to their relevance, including the Climate Change in the Region of Murcia roadmap, the Strategy for Mitigation and Adaptation to Climate Change in the Region of Murcia, the Energy Plan of the Region of Murcia, and Civil Protection Plan against risk of flooding, forest fires among other sectorial plans.

In accordance with the Local Council of Stakeholders, the drivers of the Murcia Region as enabling factors for the climate change policies implementation were analysed in the different PESTLE aspects. It is worth to highlight, among them, some urban plans promoting new infrastructures development, business ecosystem that favour the development of PV solar energy, the promotion of circular economy and renewable energy system (and investment of local actors), neighbours associations and initiatives to promote sustainability and healthy living, or the strong industry in efficient water irrigation, or green areas protection plans.

7. Case Study 5 – Wetland (Danube Delta) characterisation

Tulcea County is situated in the South-East of Romania, in Dobrogea region, being bordered by the Danube and Black Sea. The structure of the land areas is diversified, being dominated by the agricultural uses. However, agriculture represents the major economic sector in the region, with high importance in bioeconomy area, fostering the establishment of the environment – economic development system. In the Romanian coastal region, the agricultural sector accounts for 32 % of jobs (30 % in the whole country). This document presents an overview of the most recent available data regarding the development of economic activities in Tulcea county, with impact on the rural development.

The case study is comprised of 1 municipality: Tulcea Municipality, 4 towns: Babadag, Isaccea, Măcin and Sulina - and 46 administrative bodies.

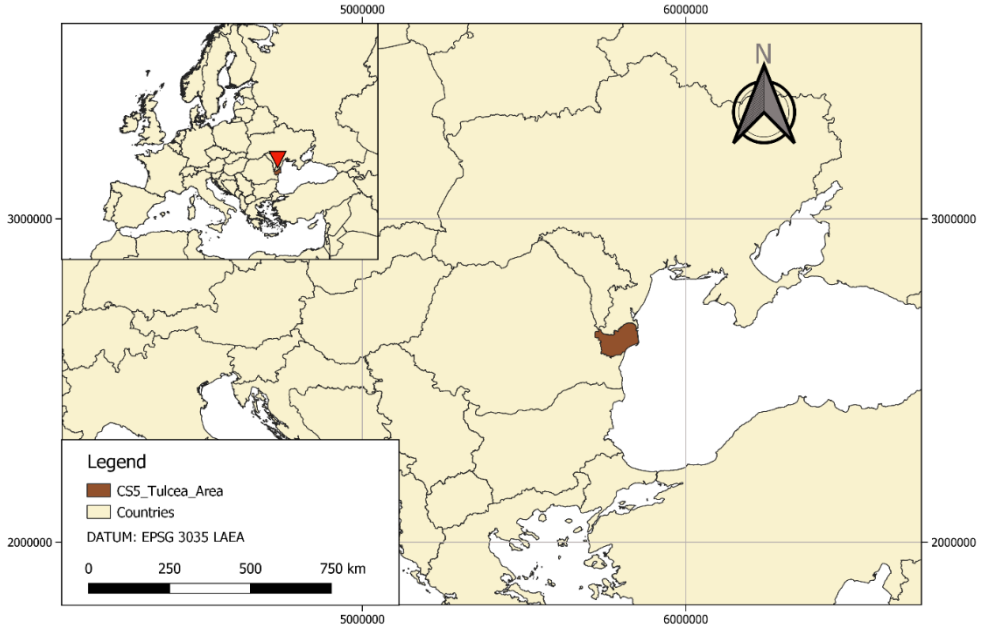


Figure 171. Location of CS5, Tulcea Region.

The fluvial and marine zone of Tulcea County, territorially corresponding to the most important protected areas in Romania and Europe, connects the Black Sea coast to the county`s continental part. Generated by the mouths of the Danube and with a historical evolution, Danube Delta has a particular importance than other areas of Romania, due to its geographical position (the EU eastern border area), its natural resources (both aquatic and landscape), its ethnic and cultural diversity (traditions, customs, architectural elements, traditional cuisine, etc.), as well as its recognized economic and tourism potential, but which, paradoxically, hasn't changed its poor area status yet. An area facing various demographic challenges and regional disparities, but has added value given the lack of industrial activities that could affect the landscape. The multiple statuses of the Danube Delta (Ramsar Wetland site, Natura 2000 site, biosphere reserve and UNESCO world natural heritage site), the particular physical and geographical conditions of the area, as well as the presence of human settlements, determine a number of restrictions and limitations in the development of the fluvial a marine area. Due to the lack of a central coordinating mechanism of fluvial and maritime area, the diversity of intervention areas is doubled by a corresponding institutional complexity (i.e. five ministries having responsibilities in this area), institutional coordination being often complicated by the lack of communication, resources or the existence of incompatible interests. The management model of the area is in accordance with the recommendations of the UNESCO "Man and Biosphere" Programme and the Convention on World Cultural and Natural Heritage Protection. To be noted that public and

environmental policies dominate this area, and the European environmental policy, well supported financially, gives Romania the chance to finance important investments in Danube Delta Biosphere Reserve. The cultural component, invariably linked to the history of the Danube Delta, doesn't benefit of the same opportunities/attention, thus the number of projects on restoration, preservation and harnessing the cultural heritage is relatively low compared to other areas of the country. Under these conditions, the preservation and protection of cultural heritage, especially the archaeological and historical one, is the main challenge[58].

The climate of Tulcea county is excessively continental, with low precipitation, with high atmospheric humidity in the delta area, hot summers, cold winters, often marked by blizzards, high temperature amplitudes (66.3°C). Average annual precipitation totals between 359 mm in Sulina (the lowest in the country) and 445 mm in Isaccea. Predominant winds blow with greater frequency from the NE (18.3%), followed by those from the NW (17.1%), E (15.2%) and N (13.1%), with average annual speeds ranging from between 0.8 and 5.3 m/s. The approach to the continental area of Russia brings cold air that comes from the northeast to the southwest, resulting in a wind called crivăt, which brings very cold winters, sometimes even freezing the Danube and the Delta for a period of two to three months. In summer, strong winds bring warm and dry air that dries the earth and turns the soil into dust. Temperatures are lower in the west, in the hilly area, while on the coast (Sulina), the sea breeze brings warm and humid air, recording the highest winter temperatures in the country.

7.1. Analysis of geographical landscape and historical climate conditions

This section includes an analysis of the historical and future climate in the Region of Tulcea and also the main sectors that will be affected by forecast changes in the climate due to the increase of emissions and the associated effects in social, economic and environmental systems.

7.1.1. Climate analysis and characterisation of vulnerable sectors

In this initial section, two relevant objectives are covered: (i) an assessment of the main climate data (temperature, precipitation and wind) in the historical a future period (from 2023 to 2100) under two different climate scenarios for the Region of Tulcea and (ii) identification and description of the main assets per vulnerable sector that will be affected by future changes in the climate.

7.1.1.1. Climate and weather analysis

Climate analysis is based on the Essential Climate Variable (ECVs). More in detail, the following variables are evaluated: maximum annual daily cumulated precipitation, mean annual daily cumulated precipitation, mean annual daily maximum temperature, mean annual daily minimum temperature, mean annual daily mean temperature and mean annual daily mean surface wind speed.

- **Temperature**

If we analyse the obtained results of climate models in the future for temperature, we identified that the mean annual daily temperature in the Danube Delta (11.84ºC in the historical period) will increase according to the two considered climate scenarios. It is expected that the mean annual daily temperature increases in more than 5.3ºC in the most unfavorable scenario (SSP585) in the long term. In this sense, the temperature will increase more than 17ºC by 2100. Considering the minimum and maximum mean annual daily temperature, the same pattern is expected facing a warmer climate with

[58] https://projects2014-2020.interregeurope.eu/fileadmin/user_upload/tx_tevprojects/library/Territorial%20analysis%20and%20%20identification%20Tulcea%20County%20(RO).pdf

very high temperature in extremes. Table 43 presents the temperature results in the Danube Delta for two different scenarios (SSP245 and SSP585) and the comparison with the mean values in the historical.

Table 43. Mean, Maximum and Minimum temperature and related anomalies comparing with the historical. Lighter red colour implies smaller changes while dark red implies higher changes.

Scenario and period		Mean temperature	Mean maximum temperature	Mean minimum temperature
Historical scenario		11.84	14.86	8.61
SSP245 scenario	**2023-2039**	13.06	16.17	9.87
	2040-2069	13.95	17.05	10.73
	2070-2100	14.72	17.86	11.59
SSP585 scenario	**2023-2039**	13.31	16.32	10.01
	2040-2069	14.60	17.66	11.38
	2070-2100	17.17	20.34	13.97
Anomaly SSP245 scenario	**2023-2039**	1.22	1.31	1.26
	2040-2069	2.11	2.19	2.12
	2070-2100	2.89	3.01	2.98
Anomaly SSP585 scenario	**2023-2039**	1.47	1.46	1.40
	2040-2069	2.76	2.80	2.77
	2070-2100	5.33	5.49	5.36

Figure 172 presents the results of the evolution of mean annual daily temperature along the period 2015-2100 using downscaled data from eight different climate models for the SSP245 climate scenario. The average value for the eight models under SSP245 is presented in Figure 173 where the confidence interval is represented by the maximum and minimum value of the set of models in each simulation year. The same representation for the temperature variation under SSP585 climate scenario is included in Figure 174 and Figure 175 respectively. Results show a high heterogeneity between models and scenario with a growing trend along the evaluated period in both scenarios, being higher the temperature increase in the most extreme scenario (SSP585).

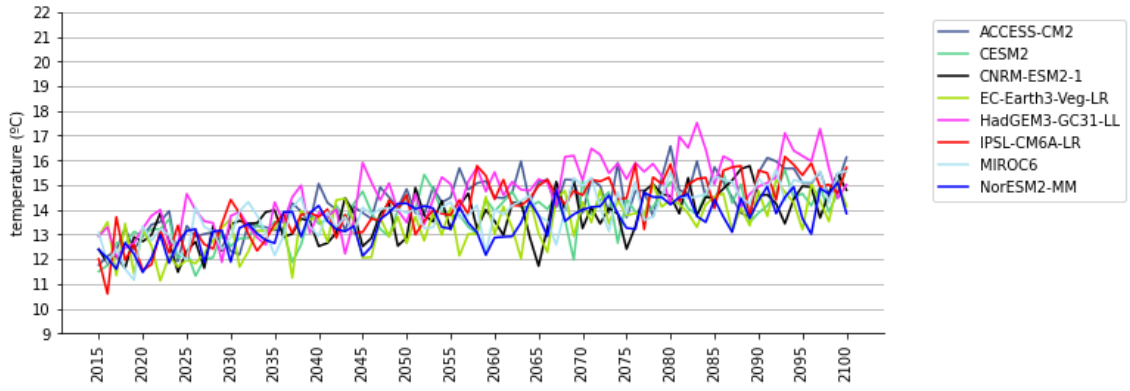


Figure 172. Mean annual daily temperature in the SSP245 scenario (2015-2100) for eight models in the Danube Delta obtained by statistical downscaling procedure.

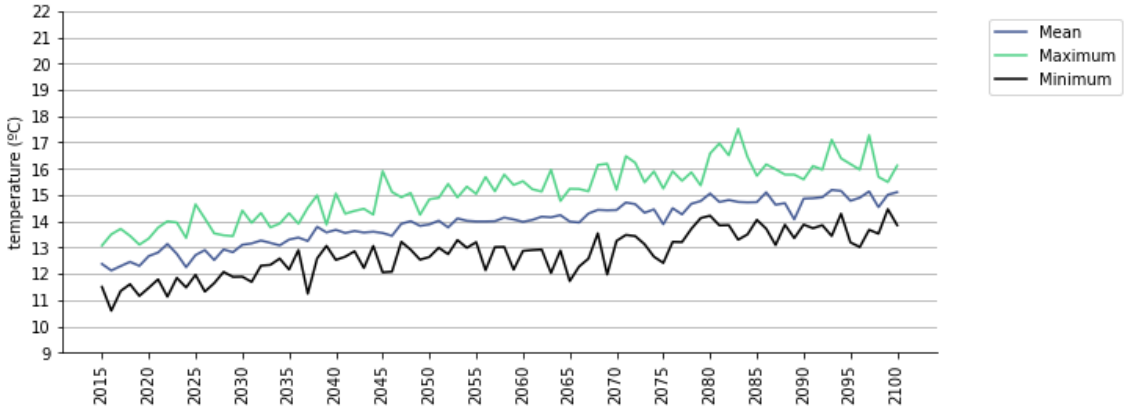


Figure 173. Ensemble mean annual daily temperate and range of variation (Maximum and Minimum) for a set of eight models in the SSP245 scenario (2015-2100) for the Danube Delta.

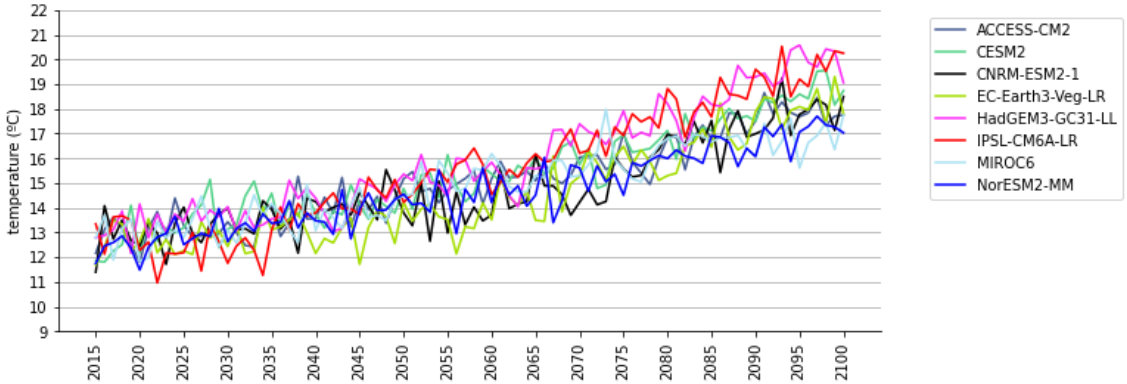


Figure 174. Mean annual daily temperature in the SSP585 scenario (2015-2100) for eight models in the Danube Delta obtained by statistical downscaling procedure.

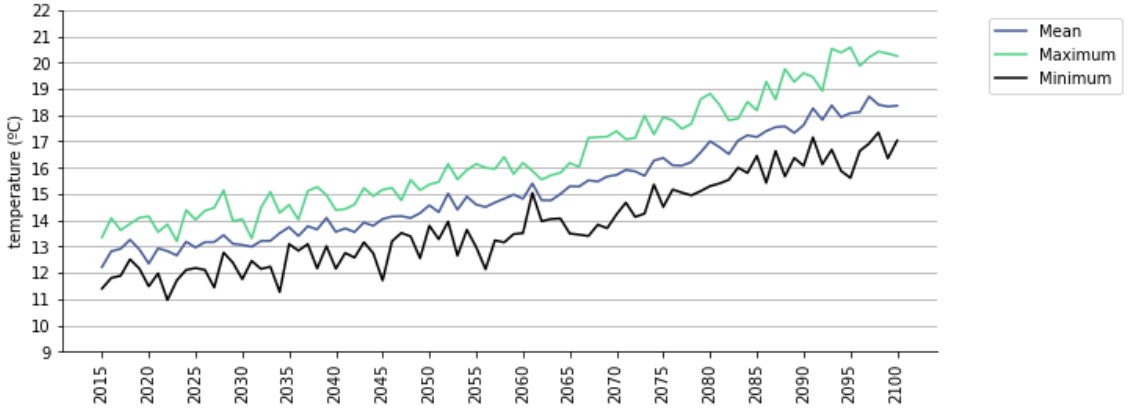


Figure 175. Ensemble mean daily annual temperate and range of variation (Maximum and Minimum) for a set of eight models in the SSP585 scenario (2015-2100) for the Danube Delta.

○ Precipitation

The evolution of precipitation in the future shows a slightly decreasing trend, which is completely contrary to that observed for temperatures, where a very pronounced increase is predicted. Considering its evolution throughout the time periods analyzed (Table 44), the decrease in precipitation will be more visible in the most unfavorable scenario (SSP585). The mean annual daily cumulated precipitation observed in the historical period is 1.72 mm/day, which is equivalent to an annual precipitation of 627.8 mm. The results of the models for the future, forecast a reduction in

precipitation of up to 12.21% in the most unfavorable scenario. This decrease will mean ceasing to have an average of 76.65 mm of precipitation per year, which can cause a deficit of water resources at regional level in the long term. On the other hand, the maximum annual daily cumulated precipitation increases in all evaluated periods except in the long term in the most unfavorable scenario where there is more uncertainty. This puts us in front of a scenario of more torrential events in the Danube Delta.

Table 44. Mean and Maximum annual daily cumulated precipitation and related anomalies comparing with the historical. Lighter blue colour implies smaller changes while dark blue implies higher changes.

Scenario and period		Mean annual daily cumulated	Maximum annual daily cumulated
Historical scenario		1.72	36.95
SSP245 scenario	**2023-2039**	1.76	40.20
	2040-2069	1.71	40.18
	2070-2100	1.69	39.49
SSP585 scenario	**2023-2039**	1.69	39.42
	2040-2069	1.67	40.70
	2070-2100	1.51	40.31
Anomaly SSP245 scenario	**2023-2039**	0.04 ↑	3.25 ↑
	2040-2069	-0.01 ↓	3.24 ↑
	2070-2100	-0.03 ↓	2.55 ↑
Anomaly SSP585 scenario	**2023-2039**	-0.03 ↓	2.48 ↑
	2040-2069	-0.06 ↓	3.75 ↑
	2070-2100	-0.31 ↓	3.36 ↑

Figure 176 presents the results of the evolution of the mean annual daily cumulated precipitation along the period 2015-2100 using downscaled data from eight different climate models for the SSP245 climate scenario. The average value for the eight models under SSP245 is presented in Figure 177 where the confidence interval is represented by the maximum and minimum value of the set of models in each simulation year. The same representation for the mean annual daily cumulated precipitation variation under SSP585 climate scenario is included in Figure 178 and Figure 179 respectively. The results by model have great heterogeneity, which is very visible in the figures for comparing the results of the models, where no clear trend is observed by model evaluating the precipitation results.

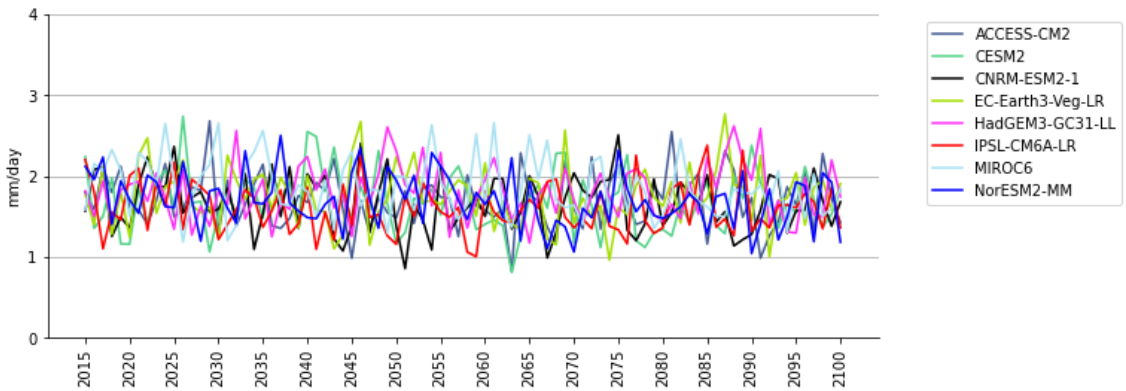


Figure 176. Mean annual daily cumulated precipitation in the SSP245 scenario (2015-2100) for eight models in the Danube Delta obtained by statistical downscaling procedure.

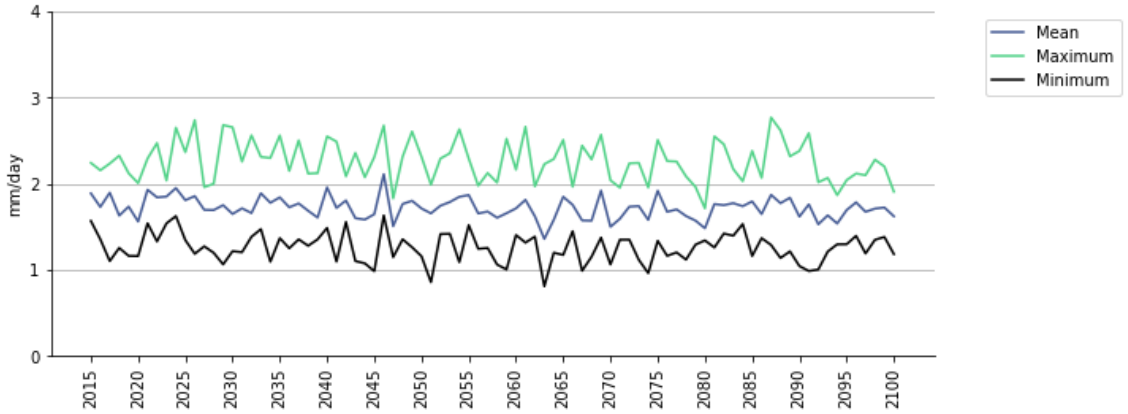


Figure 177. Ensemble mean annual daily cumulated precipitation and range of variation (Maximum and Minimum) for a set of eight models in the SSP245 scenario (2015-2100) for the Danube Delta.

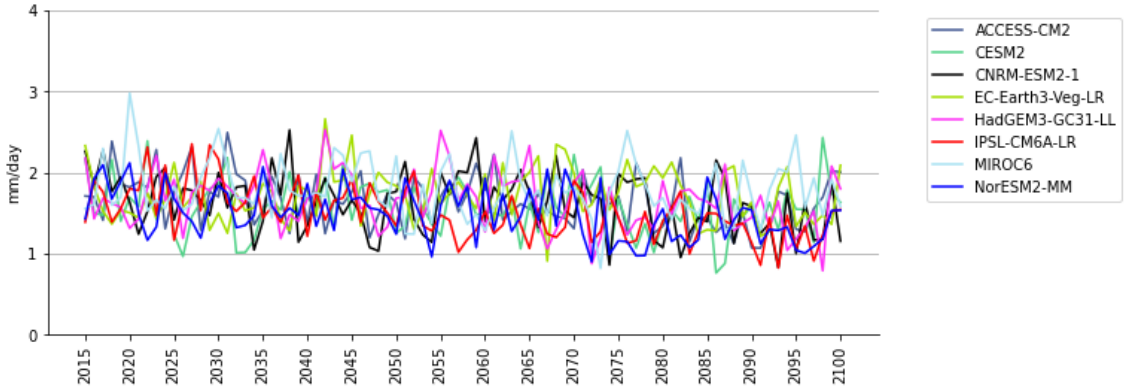


Figure 178. Mean annual daily cumulated precipitation in the SSP585 scenario (2015-2100) for eight models in the Danube Delta obtained by statistical downscaling procedure.

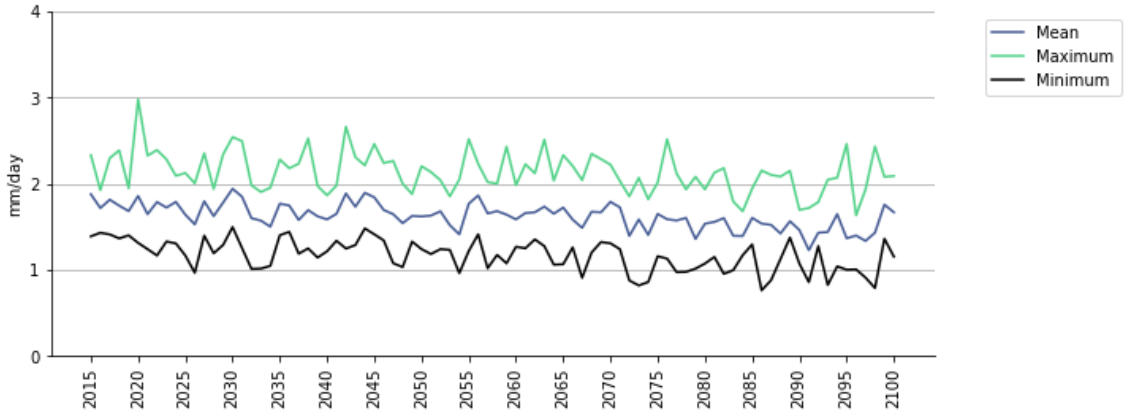


Figure 179. Ensemble mean annual daily cumulated precipitation and range of variation (Maximum and Minimum) for a set of eight models in the SSP585 scenario (2015-2100) for the Danube Delta.

○ Wind.

Analyzing the results of the two selected climate scenarios for the future to analyze the evolution of the mean annual daily wind speed in the Danube Delta, a trend is observed that projects a small decrease in the average wind speed if we compare it with respect to the average value of the historical scenario (Table 45). These changes in wind speed are conditioned by the increase in temperatures, together with the roughness and sealing of the land surface. However, and despite the forecast

decrease, the average value will not fall below 4,54 m/s even in the most unfavorable scenario (SSP585)

Table 45. Mean annual daily surface wind speed and related anomalies comparing with the historical. Lighter grey colour implies smaller changes while dark grey implies higher changes.

Scenario and period		Mean annual daily surface wind speed
Historical scenario		4.68
SSP245 scenario	2023-2039	4.66
	2040-2069	4.65
	2070-2100	4.61
SSP585 scenario	2023-2039	4.62
	2040-2069	4.60
	2070-2100	4.54
Anomaly SSP245 scenario	2023-2039	-0.02
	2040-2069	-0.03
	2070-2100	-0.07
Anomaly SSP585 scenario	2023-2039	-0.06
	2040-2069	-0.08
	2070-2100	-0.14

Figure 180 presents the results of the evolution of the mean daily wind speed along the period 2015-2100 using downscaled data from six different climate models for the SSP245 climate scenario. The average value for the six models under SSP245 is presented in Figure 181 where the confidence interval is represented by the maximum and minimum value of the set of models in each simulation year. The same representation for the mean annual daily wind speed variation under SSP585 climate scenario is included in Figure 182 and Figure 183 respectively. It is observed that wind prediction follows a constant trend in the future with high heterogeneity between model results in both scenarios.

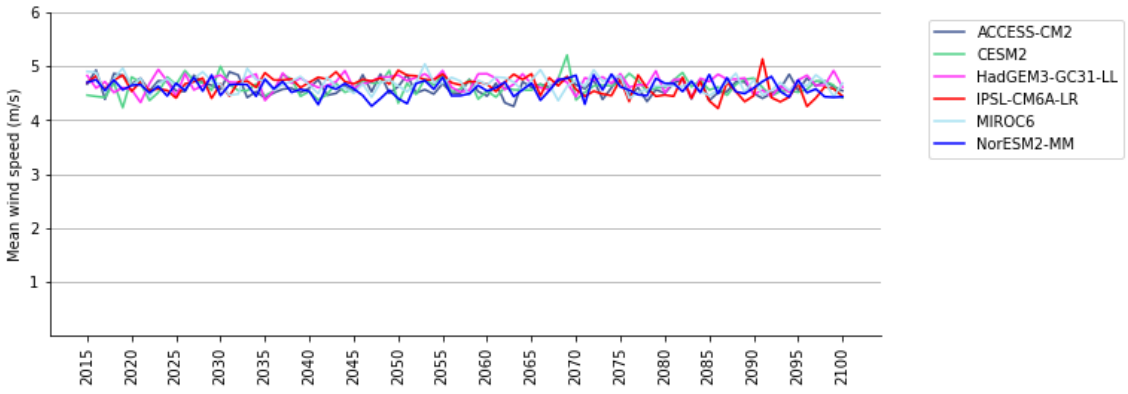


Figure 180. Mean annual daily wind speed in the SSP245 scenario (2015-2100) for six models in the Danube Delta obtained by statistical downscaling procedure.

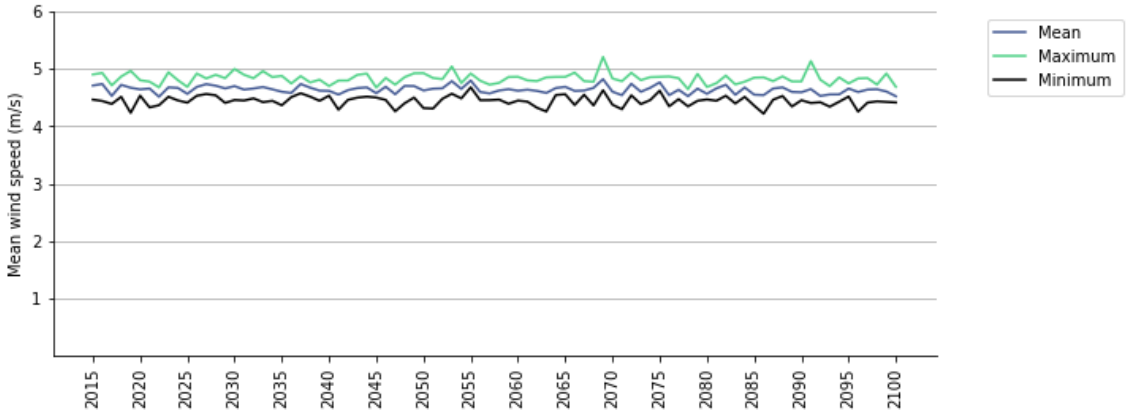


Figure 181. Ensemble mean annual daily wind speed and range of variation (Maximum and Minimum) for a set of six models in the SSP245 scenario (2015-2100) for the Danube Delta.

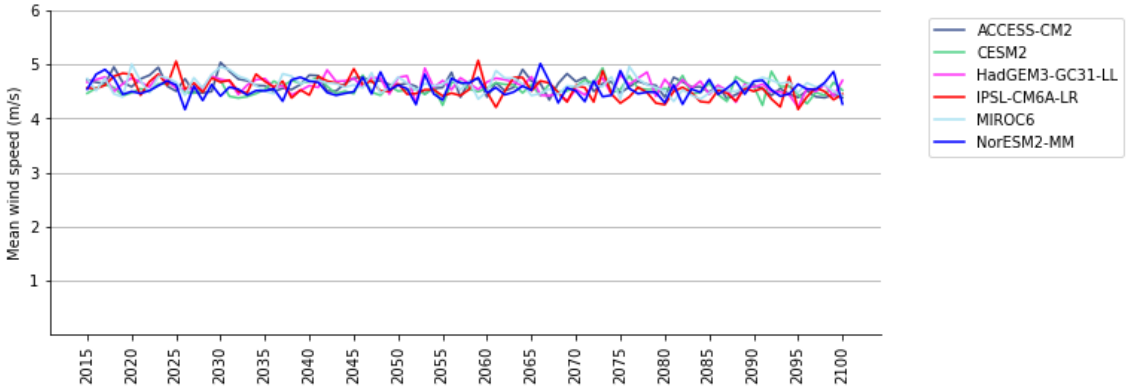


Figure 182. Mean annual daily wind speed in the SSP585 scenario (2015-2100) for six models in the Danube Delta obtained by statistical downscaling procedure.

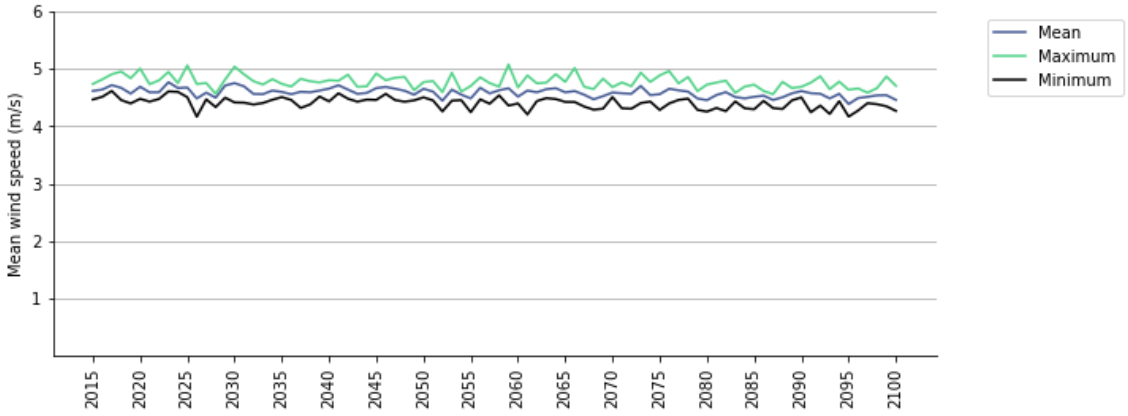


Figure 183. Ensemble mean annual daily wind speed and range of variation (Maximum and Minimum) for a set of six models in the SSP585 scenario (2015-2100) for the Danube Delta.

7.1.1.2. Vulnerable sectors: identification of exposure assets

As introduced in section 2.1.1.2, the key vulnerable NEVERMORE sectors for Tulcea case study are agriculture, forest and fishing, energy, water and waste, and tourism, leisure and cultural heritage, for the high priority sectors, and with a lower level priority the sector of industry and commerce.

This was agreed with case study leaders in the first consultation (internal) as contrast exercise with the challenges and vulnerable sectors reported at proposal stage. The activity consisted on an online

Jamboard in which the CS leaders identified their main challenges, to then relate them with the sectors and priorities for them (results can be seen in Figure 184).

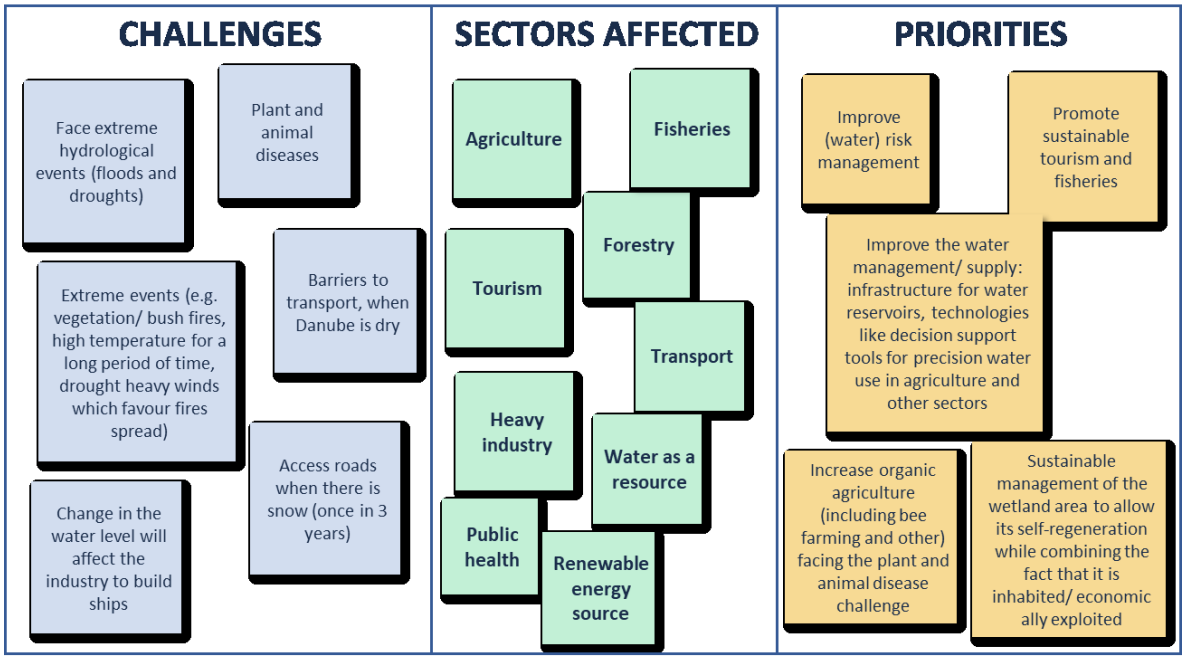


Figure 184. Results of the consultation with Tulcea case study leaders on the CS challenges, related sectors affected and priorities

Then, the first consultation with the Local Council stakeholders was held, and a similar activity to confirm the selection and heard other voices on this was performed. During this activity (developed the 2nd March 2023 in an in-person workshop) of challenges identification, stakeholders highlighted the need to focus on the fields on which climate change have a significant impact, namely the energy field, transport, sanitation, public lighting, biodiversity, green spaces or urban regeneration.

Finding funding sources for the implementation of plans and strategies in the field of climate change, with an emphasis on identifying funds for the implementation of projects aimed at reducing the effected of climate change in the Danube Delta Biosphere Reserve, aimed at the unclogging of canals, lakes, tourists' routes with kayaks or restoration, which constitute a priority for respondents.

It was also discussed around the influence that climate change has on the behaviour of employers and employees, the probability of the appearance of new risks of work accidents or the intensification of the professional reconversion process.

With respect to the sectors affected by climate change for the Tulcea County/ Danube Delta, they agreed that the most relevant from the climate change point of view were agriculture, health, environment, tourism and forestry sector.

○ Agriculture, forestry and fishing

The economic development of Tulcea county region is highly influenced by the existence of the Danube Delta Natural Reserve in the immediate neighbourhood. The agriculture sector must comply with the environmental restrictions imposed by the legislation regarding protected areas. The agricultural activities across the region have gone through major changes in the last 30 years and this is reflected in the structure of vegetal species cultivated. The region is intensively exposed to climate change dynamics, such as drought and desertification processes, which contribute to the amplification of the vulnerability of rural livelihoods. Inside the hinterland, the agriculture is the main one way of exploiting the land, being a source important income for the rural community.

Tulcea county owns a land fund that stretches up to 849,875 hectares, of which 363,941 ha are agricultural.

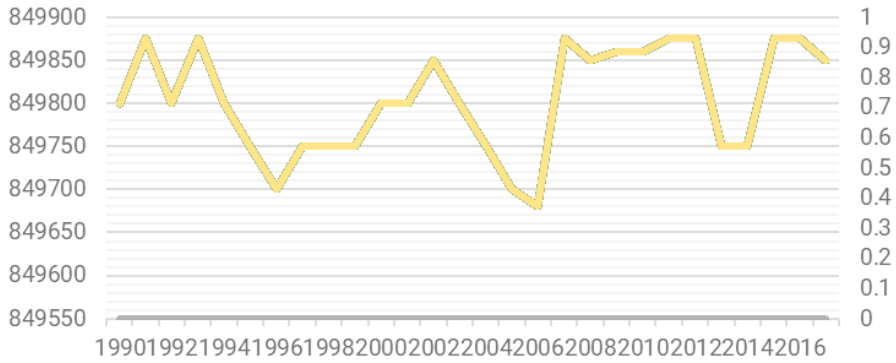


Figure 185. Evolution of cultivated area, Tulcea county

Tulcea County economy is dominated by agriculture (both vegetal and animal sector) and fishing. Agriculture is the main economic activity of the South-East region, employing over 35% of the active population. In the last three decades, the population of Tulcea county has decreased, reaching the lowest density in the country. The vegetal sector is characterized by extensive production systems, dominated by cereal cultivation. Most of the producers are organized in subsistence and semi-subsistence farms. The agricultural sector is facing strong threats due to land degradation, much of it being salted and undergoing an acidification process.

However, compared to European countries, the coastal area of Romania covers a high percent of agricultural land use. Nowadays, the agricultural sector and the rural economy in general continue to have substantial growth potential, still under-exploited.

For example, at national level, agriculture accounts for 6% of gross value added (GVA), representing 1.6% in the EU (CE, Informații statistice România, mai 2022).

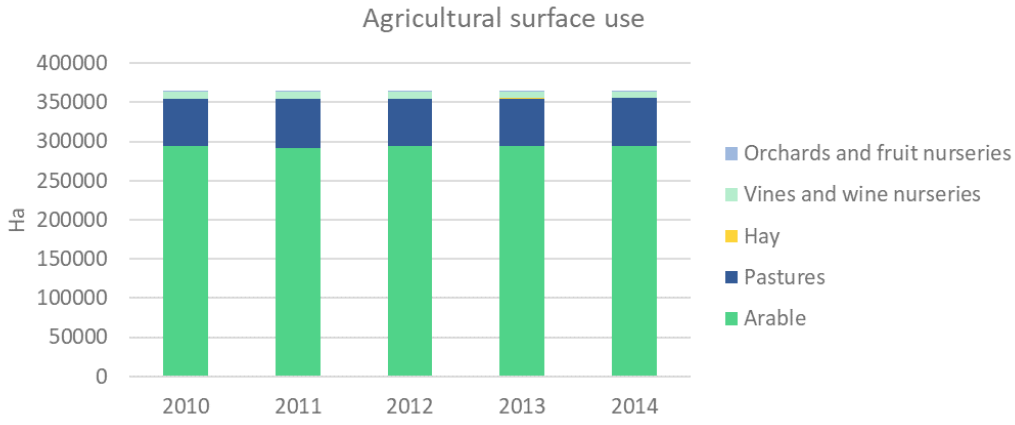


Figure 186. Agricultural land use distribution Source: Ro-INS data

The annual value productivity in agriculture has had an upward trend during the las 20 years in general, but mostly in the period 2014-2021, from 703 million € to 938 million €, by 29.75%. From the point of view of agricultural branches, the vegetable branch registered an increase of 41.37%, reaching in 2021 the value of 686.5 million € from 495.1 million €, as it was in 2014. The productivity of the main crops in Tulcea County is lower than the national and EU15 averages.

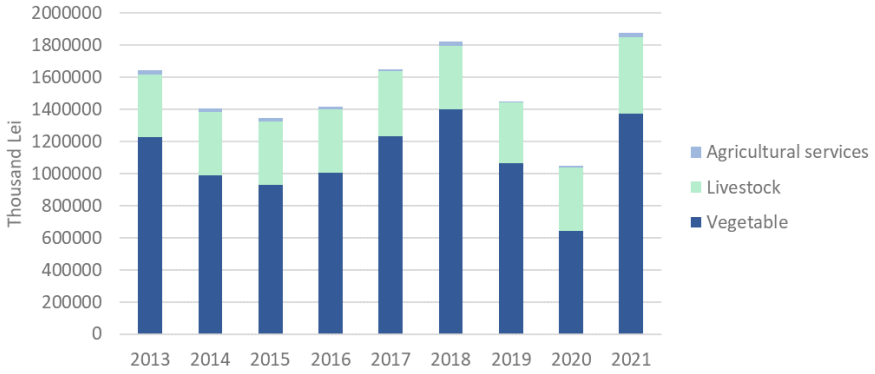


Figure 187. Productivity in agriculture (thousands Lei) by branch Source: Own elaboration based on Ro-INS data

The average yields for wheat in Romania are 2.8 t/ha, less than half of the EU15 average, while in Tulcea County the quantity is even lower: 2.2 tons/ha. In the case of corn, the situation is similar – the national average is a third of the EU15 average (3.4 tons/ha vs. 9.5 tons/ha), while the average in Tulcea is only 2.9 tons/ha. The average numbers are for the 2006-2011 period. The differences in yields are explained by the particularities of the Delta: the low quality of the soil (sandy, with high humidity) and the unfavourable climate conditions (high temperatures and low rainfall). Analysing the production of agricultural crops in the period 2014–2021, there is a fluctuant tendency of the average production of wheat, corn, barley and sorghum. In 2018 the average production reached 8,8 tons/ha, which was 4.1 tons/ha higher than in 2014, but it was as low as 1,2 tons/ha in 2020.

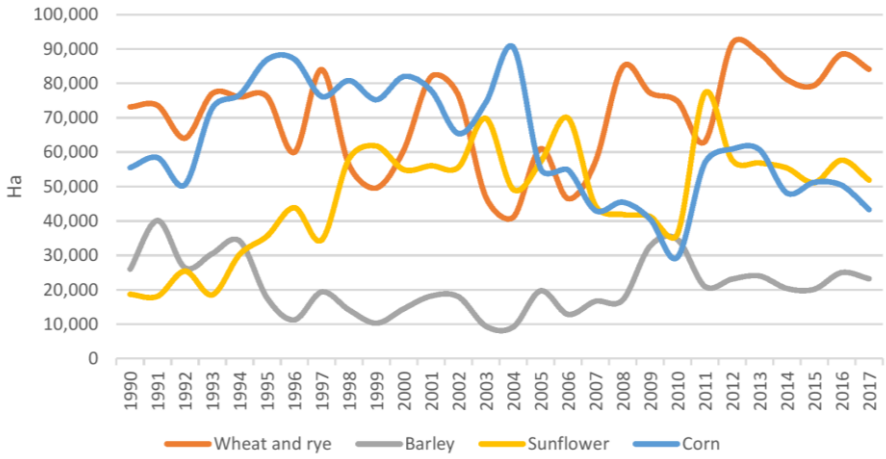


Figure 188. Multiannual evolution of the main cultivated species in Tulcea and Danube Delta Source: Steliana Rodina- Evolution of agricultural activities in the coastal areas of Romania: Case study Tulcea county

Within the coastal area of Tulcea, agriculture is the main mode of exploitation of the land, being an important income for the rural community. The rural area of Tulcea county, as it has evolved in the last 3 decades, can represent a sustainable development pole.

Table 46. Activity type of agricultural holdings and land resources. Sources comparative study on the profile of agricultural holdings without legal status in the development regions north-east and south-east of romania

County	Total area (km^2)	Density per 100 km^2			Load per 100 ha – Total agricultural area		
		Villages (nº)	Rural population (inhab)	Rural households of the population (nº)	Livestock units (nº)	Persons who work (nº)	Days worked (nº)
Total South East	37,761.70	4.00	3,302.00	1,184.00	42.00	78.00	3,906.00
Tulcea	8,498.80	1.60	1,332.00	508.00	59.00	76.00	3,836.00

As statistics show, the rural area is predominantly agricultural (Bohateret et al, 2018). A leap in development can be achieved by exploiting niche sectors, and one of these can be organic farming. For example, Tulcea occupies the second place in the country with the number of bee families, and among the first places at the number of ecologically certified bee families (Bruma et al., 2018). Moreover, from the point of view of the areas cultivated in the ecological system, Tulcea County, at the level of 2018, holds the first place in our country, approximately 62 thousand hectares, out of a total of 305 thousand national hectares.

The agricultural activities across the region have gone through major changes in the last 30 years and this is reflected in the structure of vegetal species cultivated. The region is intensively exposed to climate change dynamics, such as drought and desertification processes, which contribute to the amplification of the vulnerability of rural livelihoods. For the future, the coastal area will probably follow the overall international trend to move from agricultural economy to a so-called rural economy, including in its structure all forms of tourism and services. Agriculture will still be an important part of the rural activity, but a promising direction of development could be orientation towards providing traditional, local products, as the demand for such products has an increasing trend, lately. This kind of products are expected to bring an added value to the economy of the region, alongside with the mass production of standardised products.

Animal sector is poorly represented in the Tulcea county. In 2004 there were operating only 2 pig intensive farms. However, the county had a flock of about 250,000 sheep, ranking first in the number of sheep and wool production on national level.

After 10 years of governmental incentives, the sheep and goat flocks, started an upward trend. In 2021, at the level of Tulcea county, a number of 394,936 sheep were registered, this number being almost 80,000 more than in 2014. In the same period, the number of goats also increased up to 82,888 heads in 2021, from 69,752 heads in 2011.

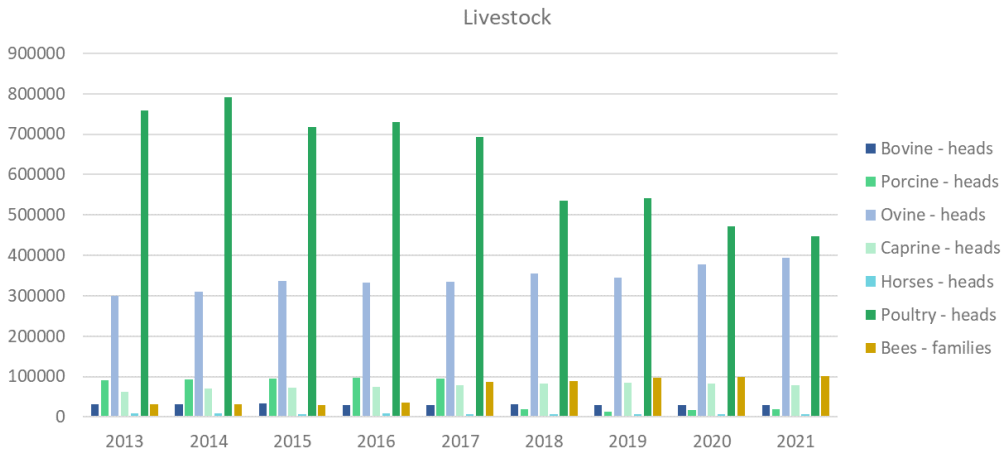


Figure 189. Evolution of livestock. Source: Own elaboration based on Ro-INS data

The number of pigs has been relatively constant up to 2020, when it was considerably reduced, reaching a value of 13,095 heads, compared to 93,993, as they were registered in 2014. The decrease of more than 80,000 livestock, was determined by the measures taken in the context of the African swine fever, Tulcea being among the most affected areas of the country.

A major positive development in the period 2011–2021 concerns the number of bee families. In 2021, the number of bee families tripled the value of 2011, up to 101,454 families compared to 2011, when their number was 30,701. Yet, the amount of honey production increased only by 133 percentage

points in 2018, reaching 1,562 tons, compared to 2011 with 668 tons. Another downfall was in 2020, when honey production was only 972 tons.

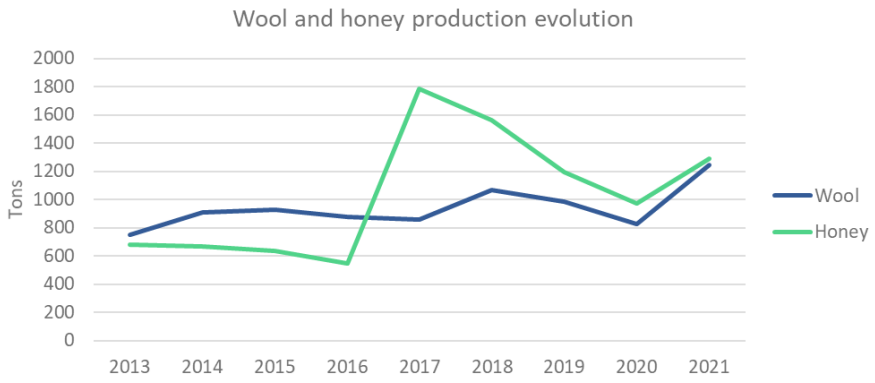


Figure 190. Evolution of wool and honey productivity. Source: Own elaboration based on Ro-INS data

Due to the large surface areas of water, fish farming is a strong point of the Tulcea economy. The Romanian fish industry occupied a leading place during the communist period, it was in third place in the world, after the Soviet Union and East Germany. Since the 60s, Romania had a huge ocean fishing fleet with dozens of ships that crossed the world's oceans and brought horse mackerel, mackerel, sardine, cod and herring into the country. Two important fish product factories were located in Tulcea and Sulina. After the communist era and after a complete dissolution of the fishing fleet, Tulcea fish production has dropped to less than 7,000 tons per year in 1997 and the statistics from 2004 record a total of about 3,470 tons, with the quantities broken down by species that are shown in Table 47 and Figure 191, as well as its comparison with 2020' statistics, that are even more dramatic.

Table 47. Statistics of the quantities of fish species production in 2004 and in 2020, in tonnes

Specie	2004	2020
Crucian carp	1790.0	1100.0
Carp	102.0	145.0
Catfish	163.6	62.6
Sole	153.5	70.0
Pike	164.5	16.5
Mackerel	47.6	4.0
Babushka	268.8	178.0
Phytophagous	59.2	62.2
Bream	720.5	229.0

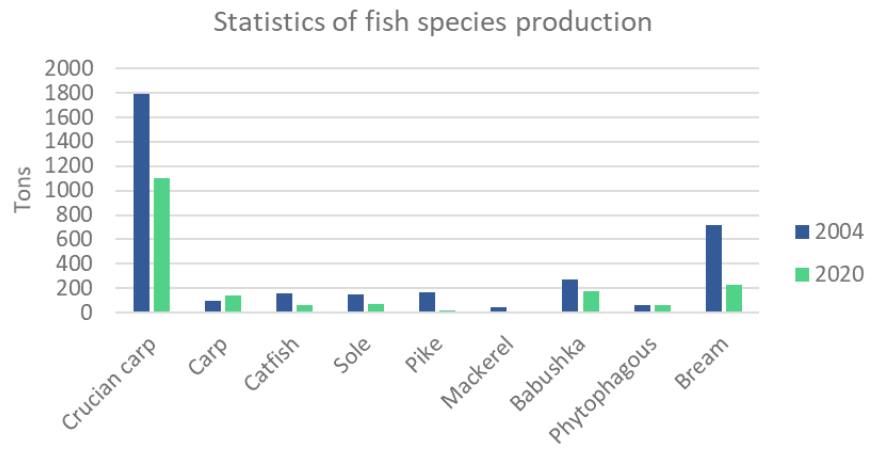


Figure 191. Statistics of the quantities of fish species production in 2004 and in 2020

The fisheries and aquaculture facilities in the Danube Delta are currently facing negative aspects:

1. Different treatment of aquaculture policies compared to the policies of agriculture. The major discrepancy between the two sub-sectors resides in different approaches to payment methods- direct for agriculture and indirect for fisheries and aquaculture. The result was the conversion of fish into aquaculture farm, just to be able to collect the incentive.
2. Climate change. In the medium- and long-term climate change can determine changing the hydrological regime of the water supply sources an aquaculture farm. As a result of the decrease in water volumes available in certain aquaculture farms, and of competition with others users (irrigation, recreation, tourism, etc.).
3. Lack of labour force dedicated to this sub-sector. Aquaculture and fish processing face labour force shortages, mainly due to the lack of attractiveness of the aquaculture activity.
4. Application of a set of measures for the protection and improvement of the environment and natural resources, for the conservation of natural resources and biodiversity, for managing the landscape and traditional fishing and aquaculture without proper consultation of the local communities' farmers and the restriction of the aquaculture activity, caused losses in income and, finally, abandonment.
5. The negative impact of natural disasters, meteorological phenomena or anthropogenic causes: ecological disasters, unpredictable climate changes that affect the quantity and water quality, losses caused by drought, floods, torrents, floods.

Regarding the evolution of forest in Tulcea county, during the period of 2011-2021, the trend is oriented towards a slight increase, from 92,200 hectares of forests in 2011 to 105,100 hectares in 2021.

However, the number of hectares subjected to artificial regeneration activities decreased from 793 ha, which was the value of 2011, to only 162 hectares in 2021, a value that constitutes only 20.42%. Regarding the structure of the wood harvested in 2018, softwood has the largest share of the total, with a percentage of 73.72%, followed by hardwood which in percentage of 20.03% of the entire amount of harvested wood. With a percentage of 6.15%, oak represented a third in terms of wood exploitation in 2018.

Forestry within the Danube Delta has had a rather chequered history, mainly due to the use of inappropriate species to create plantations. Plantation forests cover 5,400 ha, but this area is set to decline as the trees are cropped and natural forests are encouraged to regenerate for ecological reasons. Natural forests of willow, oak, ash, white poplar and aspen cover 8,000 ha of the Danube Delta territory. Softwood species (95%) are prevailing. Apart from providing important harbours for biodiversity (73% of surface), forests are used for wood production (27% of the surface). Forests of economic interest are concentrated in the fluvial delta. Apart from wood harvesting, the picking of mushrooms, medicinal plants, and hunting are common. Forestry absorbs a small fraction of the labour force in reserve. Increasing the employment rate in this area can be done by promoting traditional activities (wickerwork, etc.). The hybrid poplar plantations, black locust and green ash plantations have a strong negative impact on natural surroundings. The indigo bush which is alien species in this area, develops in the shrub layer of poplar plantations and from there spreads into natural habitats. The black locust and green ash are also invasive species spreading throughout the delta (Adaptarea Deltei Dunării la schimbările climatice | WWF Romania).

- **Energy**

According to the list of electricity suppliers published by the National Energy Regulatory Authority, the main supplier of electricity in Tulcea County is ENEL ENERGIE SA, by E-Distribuție Dobrogea, that operates the network with 120 transformer stations, 6,329 transformer positions and 6,578 MVA power.

The infrastructure of the electricity supply system consists of transformer stations, transformer substations, power lines (above ground and underground) and low voltage lines. Transelectrica SA has made a mega investment at the county level, Tulcea having the largest eco electricity transformation station after the refurbishment of the 400/110/20 kV Tulcea Vest Transformation Station. The 400/110/20 kV Tulcea Vest station is considered an important node in the electrical transport network, being the source of electricity supply for the municipality of Tulcea and the large industrial consumers in the county, with an emphasis on two biggest industrial platforms Vimetco Alum[59] and Tulcea Vard shipyard[60].

The statistical data includes the energy sector under the generic activity of "*Production and supply of electricity and thermal energy, gas, hot water and air conditioning"* which has an upward evolution for the last 10 years.

Table 48. Active companies and turnover from active local companies (Million €).

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Active companies [Nº]	21	30	33	27	19	17	15	14	12
Turnover from active local companies [Mil. €]	138	96	133	192	253	410	641	739	992

In terms of productivity, the sector is very profitable, if we compare the evolution of the turnover according to a relatively stable number of employees: 321 in 12 companies in 2021, from 410 in 21 companies in 2013.

Dobrogea is considered one of the most promising regions in Europe in terms of wind potential. Specialists say that the only region comparable to Dobrogea, from this point of view, is the North of Scotland. The South Eastern area between the Danube and the Black Sea has an average intensity of 7.2 m/s throughout the year, representing an ideal place for the location of wind turbines. In addition to the permanent and constant intensity of the wind, Dobrogea also has a favourable relief for the wind industry. The territory is relatively flat and the population density is low. According to the Tulcea Environmental Protection Agency, 83 parks received environmental approval, the total number of turbines that can be built in this area is 839[61].

○ Water and waste

From a hydrographic point of view, the case study area is part of the Hydrographic Dobrugja, Danube Delta and Coastal Waters Space. At the level of the Danube River, the Danube Delta, the Dobrogea Hydrographic Area and the Coastal Waters there is a total number of 115 bodies of surface water delimited in the following categories:

- natural, heavily modified and artificial rivers- 1,617 km, of which:
  - permanent rivers - 1,515 km (approx. 94% of the total watercourses),
  - non-permanent rivers – 102 km (approx. 6% of the total watercourses);
- natural lakes -75 with an area larger than 0.5 km^2,
- reservoirs - 6 with an area larger than 0.5 km^2,
- transitional waters -781.37 km^2 (619.37 km^2 transient marine waters and 162 km2 Lake Sinoe) and waters coastal – 571.8 km^2 (116 km).

[59] https://www.alum.ro/
[60] https://www.vard.com/location/romania/vard-tulcea
[61] https://www.ecomagazin.ro/tot-mai-multe-eoliene-in-judetul-tulcea/

According to the Danube Delta Biosphere Reserve -Report on the state of the environment, the surface of the Danube Delta includes the three branches: Chilia, Sulina, Sfântu Gheorghe - which represent major arteries, through which the Danube River provides the deltaic space with liquid and solid flow, and five hydrographic zones:

- Chilia - Sulina area between Chilia, Tulcea and Sulina branches;
- Sulina - Sf. Gheorghe area, between the Sulina and Sf. Gheorghe branches;
- The Sf. Gheorghe - Razelm area, to the south between the Sf. Gheorghe arm and the Razim lake;
- Razim - Zmeica - Goloviţa - Sinoe lagoon complex area;
- The marine area of the Danube Delta (the mouths of the Danube, the seashore and the submerged bottom in front of the Delta's coastline.

The hydrological regime of the Danube in the lower course – that characterizes the case study- is considered relatively uniform due to the ratio between the minimum flow and the maximum flow of 1/10 and which is determined by the alpine tributaries of the upper course and those of the middle course. From the analysis of the flows from 1931-2016, during the 1075 km of the lower Danube, there is an increase of the average multiannual flows from upstream – Baziaş (5561 m^3/s) downstream – at the entrance of the Danube Delta -Ceatal Chilia (6495 m^3/s), of the minimum flows (1040 m^3/s at Baziaş and 1790 at Ceatal Chilia) and maximum flows (15800 m^3/s at Baziaş and 15900 m^3/s at Ceatal Chilia) (P. Gâştescu, Elena Ţuchiu, 2012).

Analysing the variation of the average, maximum and minimum annual flows at the two extreme hydrometric stations, respectively Baziaş – entrance to the Iron Gates and Ceatal Chilia gorge – the entrance of the Danube Delta, the trends of these hydrological parameters in the period 1931-2016 are ascertained.

The average annual flows at the Baziaş hydrometric station register a slight decreasing tendency, as it results from the polynomial analysis, unlike the Ceatal Chilia hydrometric station, where the tendency is slightly increasing (*The Danube River and its Delta, Hydrogeographyc Characteristics – Actual Synthesis*- Petre Gâștescu, Elena Țuchiu).

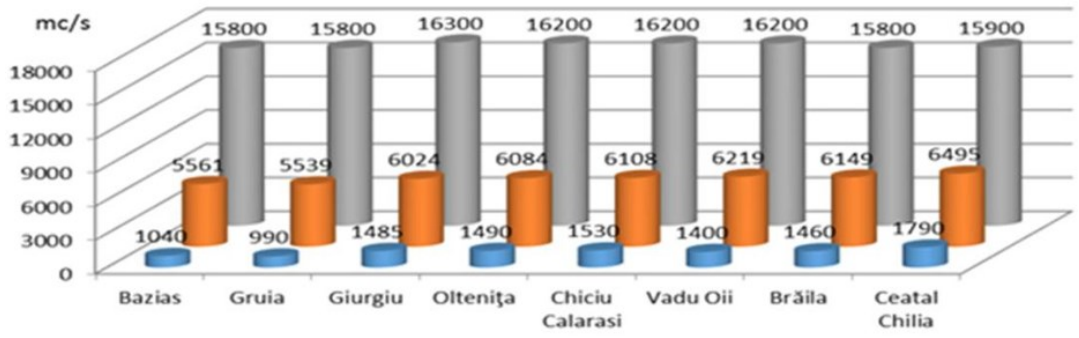


Figure 192. Multiannual average flows, annual maximums and minimums at Ceatal Chilia gorge – the entrance of the Danube Delta, compared to other the hydrometric stations on the Danube (1931 – 2016)

The hydrotechnical developments disturbed the hydrological and sedimentary functioning of the river in the lower course and considerably reduced the transport of sediments. Sediment transport usually occurs during extreme geological and climatic events such as floods. The transport of sediments from land to sea has an important role in understanding of the morphology of the riverbed and the formation of the morphological structures in the area of interaction with the continental platforms of the seas.

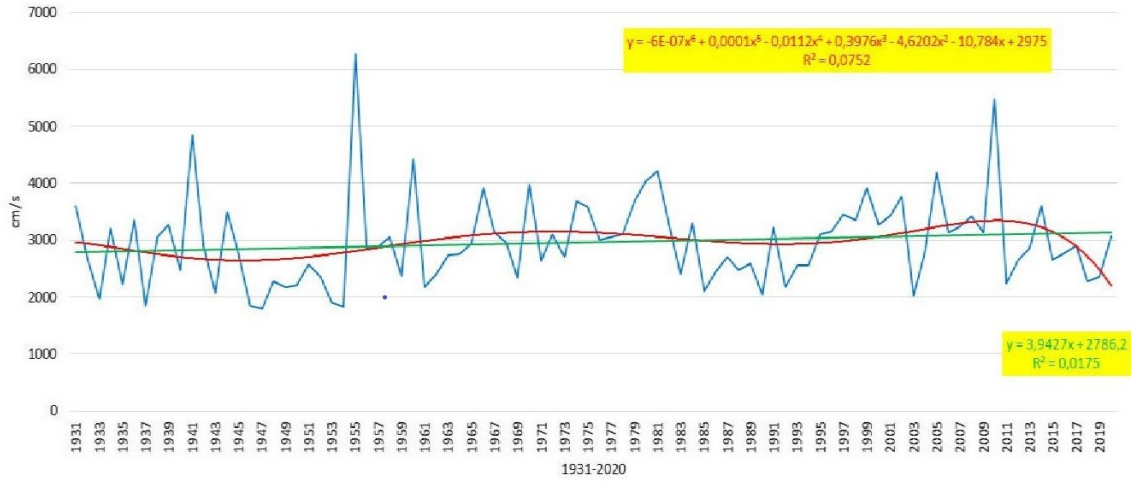


Figure 193. Multiannual evolution of the average annual flow in Ceatal Chilia – the entrance of the Danube Delta (the period 1931-2016). Source: The Danube River and its Delta, Hydrogeographyc Characteristics – Actual Synthesis- Petre Gâștescu, Elena Țuchiu

In the Danube Delta before branching, at Ceatalul Chiliei, the average multiannual flow of the Danube was estimated at 6495 m^3/s (period 1931-2016), the maximum value was registered in April 2006 (15 900 m^3/s), and the minimum in 1947 (1790 m^3/s). From the analysis of the average annual flows, for the period 1931-2016, there is a slight upward trend according to the relationship: y = 2.8505x + 6370.7, but for shorter periods there are positive / negative variations.

The flow from Ceatalul Chiliei is distributed differently in time (monitored period) depending on the morphometric parameters of the riverbed and anthropogenic changes, on the three arms - first on Chilia and Tulcea and then on Sulina and Sfântu Gheorghe. Selecting two representative years 1910 and 1990, there is a reduction of the flow on the Chila arm (from 72% to 58%) and the increase on Sulina (from 8% to 19.5%), due to the works imposed by the maritime navigation.

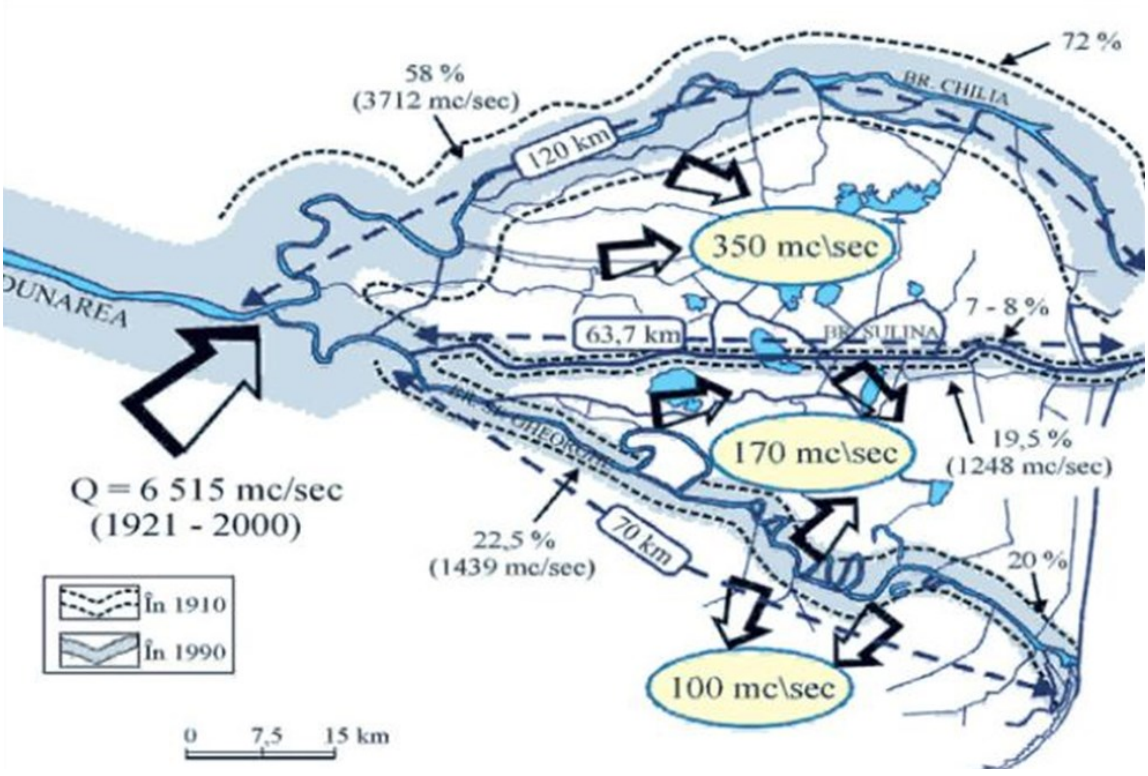


Figure 194. Distribution of liquid flows on the three arms of Danube -Chilia, Sulina and Sfântu Gheorghe

An important role in the ecological status of deltaic ecosystems is played by the liquid flow entering the lakes and canals of the lake complexes and the stagnation period during the year.

Water course	Period													
	1921-1950		1951-1960		1961-1970		1971-1980		1981- 1990		1991-2000		1921-2000	
	Qm³/s	%	Qm³/s	%	Qm³/s	%	Qm³/s	%	Qm³/s	%	Qm³/s	%	Qm³/s	%
Danube entrance(A)	6 295	100	6 476	100	6 976	100	6 892	100	6 209	100	6 240	100	6495	100
Chilia	4 018	63,8	4 074	62,9	4 244	60,8	4 076	59,1	3 606	58,1	3 390	54,3	3901	60,1
Sulina	906	11,2	1 060	16,4	1 181	16,9	1 289	18,4	1 235	19,9	1 253	20,1	1154	17,8
Sf. Gheorghe	1 236	19,0	1 293	20,0	1 382	19,8	1 510	21,9	1 399	22,5	1 583	25,4	1400	21,5
Danube at spill(B)	5 986	95,1	6 215	96,0	6 657	95,4	6 534	94,8	5 589	90,0	5 702	91,4	6113	93,8
Difference A-B	- 309		- 261		- 319		- 358		- 620		-538		- 381	

Figure 195. The liquid flows of the Danube at the entrance and exit of the Danube Delta

Potential sources of pollution such as: human agglomerations, are due to the lack of domestic or industrial waste water collection systems; agricultural activities (animal farming, excessive agriculture practices and the use of pesticides, etc.); industrial activities.

Another source of diffuse pollution is improper management of municipal waste, as well as the sludge collection and disposal from sewage treatment plants.

Considering the low population density in the case study area, compared to the national average, ensuring water supply is difficult to achieve, because the localities in the DDBR (Danube Delta Biosphere Reserve) do not have centralized sewage systems and that the existing treatment plants only carry out the mechanical pre-treatment of household water.

The purification of domestic and industrial wastewater is carried out only through the mechanical stage, using grates, sand filters, septic tanks, fats separators and settling tanks. The major sources of water pollution are represented by the economic agents located in the bordering area of the DDBR and by the naval transport in small boats and by maritime and river vessels in transit. The pollution caused by the naval transport activity is due to the fact that not all ships are equipped with efficient oil residue separators.

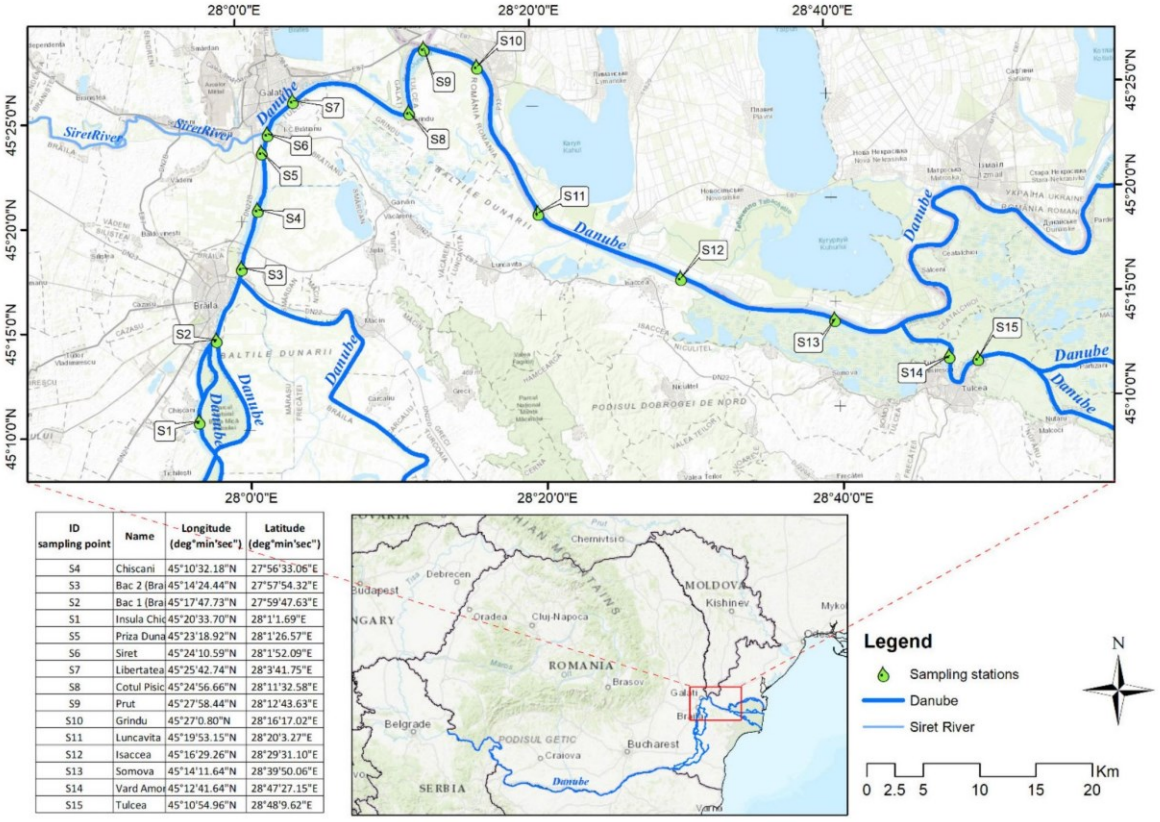
In order to avoid pollution, ARBDD imposed on the companies owning naval means of transport, the application of the POLDANUBE - 1986 recommendations to the river and the MARPOL Convention 73 - 78 by maritime vessels. As the general objective of the Water Framework Directive is to obtain a "good status" for all water bodies, the EU Member States ensure the achievement of good status of all surface waters. According to the 2013 Report on the state of the environment in the Danube Delta Biosphere Reserve, the quality of surface waters was most affected by the discharge of untreated or insufficiently treated wastewater. The following measures were applied:

- controlled waste water disposal in emissions;
- rehabilitation and expansion of sewerage networks and rehabilitation of old purification stations
- improving and wastewater treatment infrastructure
- staged construction of sewage systems and treatment plants in rural areas;
- appropriate treatment of sludge from waste water.

The results of a heavy metal study carried out in 2018-2019 (Water 2021, 13, 1801[62]) indicated that a heavy metal load with Ni and Cd in surface sediments is due to anthropogenic activities, and had an influence on the pollution levels of the lower Danube surface sediments. The average concentrations

[62] https://doi.org/10.3390/w13131801

of heavy metals analysed in the sediment were higher than the background value. However, in most sites, no significant pollution was identified for the heavy metals Pb and Cu. According to the potential ecological risk of individual metal (ErMe), the values of the RI index were influenced by the heavy metals in the following sequence: Plumb < Zinc < Copper< Nickel < Cadmium. However, the RI values revealed the existence of a low ecological risk for the surface sediments, as the limits for most heavy metals were not significantly exceeded.



ID sampling point	Name	Longitude (deg"min'sec")	Latitude (deg"min'sec")
S4	Chiscani	45°10'32.18"N	27°56'33.06"E
S3	Bac 2 (Bra	45°14'24.44"N	27°57'54.32"E
S2	Bac 1 (Bra	45°17'47.73"N	27°59'47.63"E
S1	Insula Chic	45°20'33.70"N	28°1'1.69"E
S5	Priza Duna	45°23'18.92"N	28°1'26.57"E
S6	Siret	45°24'10.59"N	28°1'52.09"E
S7	Libertatea	45°25'42.74"N	28°3'41.75"E
S8	Cotul Pisic	45°24'56.66"N	28°11'32.58"E
S9	Prut	45°27'58.44"N	28°12'43.63"E
S10	Grindu	45°27'0.80"N	28°16'17.02"E
S11	Luncavita	45°19'53.15"N	28°20'3.27"E
S12	Isaccea	45°16'29.26"N	28°29'31.10"E
S13	Somova	45°14'11.64"N	28°39'50.06"E
S14	Vard Amor	45°12'41.64"N	28°47'27.15"E
S15	Tulcea	45°10'54.96"N	28°48'9.62"E

Figure 196. Sampling Stations along the lower Danube River Source: Assessment of Heavy Metal Pollution Levels in Sediments and of Ecological Risk by Quality Indices, Applying a Case Study: The Lower Danube River, Romania

The results of the pollution indices tested indicate the existence of temporal and spatial fluctuations regarding the pollution level with certain heavy metals, due to the presence of pollution sources, heavy metal mobility, sediment characteristics, sediment transport, the hydro-morphological profile of the river and climatic conditions.

○ Tourism, leisure and cultural heritage

Due to its geographical position, Tulcea county has almost all the landforms in Romania, starting from the Măcinului Mountains - the oldest mountains in Romania and among the oldest in Europe and up to the Danube Delta - land still in formation, the newest land of the country. In Tulcea county there are 49 protected natural areas of national interest, which include 34 nature reserves and a national park, a biosphere reserve and 17 Natura 2000 sites. Tulcea ranks the first county in Romania in terms of the extent of protected areas.

The only delta in the world declared a biosphere reserve, the Danube Delta, is a true "living museum" of biodiversity that includes 30 types of ecosystems, 5,137 species of which 1,689 species of flora and 3,448 species of fauna - and one of the largest areas' wetlands in the world, ideal habitat for waterfowl.

Within the Danube Delta there are several special areas such as:

- **Roșca-Buhaiova-Hrecisca** – fauna reserve in the Matita depression where the largest pelican colony in Europe nests every spring. The lush vegetation is also home to colonies of egrets, shovelers and yellow herons;
- **Perișor-Zătoane** – wildlife reserve in the east of the Dranov depression. On an area of 14,200 ha, the most numerous swans nest, as well as the curly pelican and the cormorant. The core of the reserve consists of Zătonul Mare and Zătonul Mic lakes;
- **Periteasca-Leahova** – fauna reserve in the Razim-Sinoe lagoon complex - the most populated region with coastal birds. It includes a series of sandy banks and the lakes Leahova Mare and Mică, Periteasca, Pahane and Cosna;
- **Letea Forest** - forest reserve on the ridge with the same name. It is characterized by the abundance of climbing plants that wrap around the trees, giving the appearance of a tropical forest.
- **Caraorman Forest** - forest reserve, similar to Letea, harboring numerous tropical elements, rarities on the globe.

The Măcin Mountains National Park is located on the oldest mountains of Romania, the Măcin Mountains, characterized by bizarre microrelief resulting from the natural disintegration of granite, geological witnesses of the ancient Hercynian mountains.

The National Park occupies the highest central area of the Măcin Mountains and covers an area of 11,321 ha, of which 3,651 ha represent strictly protected areas, buffer zones totaling 7,670 ha. The Măcin Mountains represent an area with biodiversity of world importance and with a pronounced alternation of ecosystem types, which include the sub-Mediterranean and Balkan and steppe ecosystems. The great wealth of flora and vegetation of the Măcin Mountains is represented by over 1,770 plant species, of which 72 species are protected as rare or vulnerable species, and 27 species are endemic to the region.

Although dominated by special natural resources, Tulcea county also has touristic objectives of international importance, which give the territory an added appeal: archaeological remains, historical monuments of architecture and art, museums and cultural sites, monasteries and ecumenical sites that complement the touristic potential provided by the protected natural areas.

Tulcea County houses many archaeological sites and historical monuments, due to the multiple invasions. Five fortresses built by the nomadic peoples can be visited:

- ***The Medieval Fortress (Fortress) of at Enisala*** - Also known as "Heraclea", "Heraklia" or "Eracri Kiipei", the Enisala citadel is an archaeological site located in the village of Enisala, on the shore of Razim (Razlelm) lake. The Enisala citadel is a military architectural monument, built in the Middle Ages, which stands out for its planimetric design, fortification system, construction technique, architectural elements. The fortification was built in the second half of the century. XVI by Genoese merchants.
- ***Aegyssus Citadel*** - Located on the Monument Hill, in the North-eastern part of the city of Tulcea, built at the end of the century. IV BC.
- ***Argamum Fortress*** - Located a few kilometers from Enisala, is the oldest fortress in Romania and covers 120 ha. It was built in the middle of the century by the Greeks of Asia Minor.
- ***Ibida Fortress*** - Fortress located in the village of Slava Rusă, one the largest city in Roman Dacia. It covered 24 ha and is the only fortress with a river running through it.

- ***Cetatea Noviodunum*** - The citadel is located in the town of Isaccea. The name of the fortress is of Celtic origin. The emperor Darius of Persia built a bridge of vessels, in 514 BC., to pass to the Scythians, and the Greeks from the Pontic cities.
- ***Halmyris Citadel*** - The Citadel is located in Murighiol, was a strong Roman and Roman-Byzantine fortress, headquarters of some military units and station of the Danube fleet Classis Flavia Moesica.

Annual events designed to attract visitors:

- ***Tulcea Municipality Days*** -outdoor concerts, craft fairs, etc.

"As much as the pike is a thief, we take it out from under the ice" (IV edition in 2019): carp fishing competition during the period when the canals in the Luncavița fish farm freeze over.

The International Shepherding Festival (17th edition in 2019): the festival is organized in Sarighiol de Deal and presents performances by folk ensembles, dance evenings, symposia, folklore shows, literary creation, drawing and photography contests etc.

- ***The Feast of Limes*** (19th edition in 2019): the event is organized in Luncavița dedicated to linden trees and bee honey.
- ***The Dobrojazz International Festival***: aims to promote the Romanian musical traditions, but also to assimilate various traditional and influenced music from the European territory. The festival program includes recitals, film screenings, debates.
- ***Mahmudia Diversity Festival*** - Danube Delta (3rd edition in 2019), aimed to promote national culture, local traditional values (songs, dances, folk costumes, crafts, gastronomy), cultural tourism and contemporary art.
- ***Good Music Festival*** (4th edition in 2019): the event is organized in the municipality of Tulcea, the Fishing Village and aims to promote quality music.
- ***ANONIMUL International Film Festival*** (16th edition in 2019), organized in the heart of the Danube Delta, in Sfântu Gheorghe. The festival was created at the initiative of the ANONIMUL Foundation, which wanted a different film festival for independent films and young directors. The festival takes place in August every year and receives around 5000 visitors annually.
- ***International Folklore Festival for Children and Youth "The Golden Fish"*** - gathers every year Romanian and international ensembles. It is listed in the CIOFF (International Council of Organizations of Folklore Festivals and Folk Arts) calendar.
- ***The Danube Delta Gastronomy Festival*** is an event organized in Tulcea Municipality, Fishing Village.
- ***Delta Rowmania Triathlon*** (7th edition in 2019): is a competition of road triathlon, addressed to lovers of nature, exercise and outdoor sports, for professional and amateur athletes. The Delta Rowmania Triathlon is an initiative of the multiple Olympic champion in canoeing, Ivan Patzaichin, part of the Rowmania campaign to promote ecotourism destinations in the Delta
- Danube and the values of commonsense tourism, a movement that works for a better understanding and interpretation of nature.
- ***The Dichis 'n' blues Festival*** (5th edition 2019): the event is organized at the end of summer, on the last weekend in August, bringing together music with gastronomy, wine, craft beer, games and entertainment for children.
- ***Rowmania Fest, International Festival of Rowing Boats*** (9th edition in 2019): the event includes rowing competitions, workshops, film screenings, concerts.

- ***Jurilovca Lipovene Borscht Festival*** (2nd edition in 2019): in addition to the gastronomic side, the festival also includes a series of artistic events (recitals, dances).
- ***The International Tragos Theater Festival*** (17th edition in 2019): debuted in 1993, organized by the *Center for the Preservation of Popular Tradition*.
- ***Danube Delta Pike Cup*** (8th edition in 2019): sport fishing event organized in Crișan commune.

Table 49. The main tourist reception structures with tourist accommodation functions (number)

Reception structures	Years								
	2013	2014	2015	2016	2017	2018	2019	2020	2021
Total	**138**	**141**	**140**	**138**	**127**	**328**	**298**	**316**	**587**
Hotels	18	21	20	19	19	20	18	18	19
Tourist Villas	80	81	80	80	57	61	75	78	78
Tourist pensions	9	9	9	9	9	26	13	26	63
Agritourism pensions	16	16	16	15	13	133	118	113	322

Table 50. Evolution of tourist capacity in the Danube Delta. Existing tourist accommodation capacity (beds-days)

Reception structures	Years								
	2013	2014	2015	2016	2017	2018	2019	2020	2021
Total	**658,921**	**575,526**	**560,259**	**606,684**	**676,040**	**1,171,816**	**1,203,987**	**996,687**	**1,049,212**
Hotels	497,566	501,054	500,283	500,062	504,506	573,127	544,869	423,241	480,263
Tourist Villas	43,801	5,325	18,666	21,960	61,769	81,638	113,909	59,728	79,584
Tourist pensions	9,720	3,947	5,229	5,384	14,288	38,496	39,677	44,016	26,370
Agritourism pensions	26,372	19,048	20,785	23,434	4,148	30,4073	342,416	255,485	312,865

Table 51. Evolution of tourists' number in the Danube Delta. Accommodated tourists (number)

Reception structures	Years								
	2013	2014	2015	2016	2017	2018	2019	2020	2021
Total	**80,992**	**66,242**	**69,076**	**73,114**	**100,430**	**168,173**	**168,412**	**119,429**	**139,633**
Hotels	62,124	53,477	59,060	54,852	71,301	89,641	86,084	41,181	60,288
Tourist Villas	6,160	638	1,680	6,154	12,665	13,771	16,536	75,24	9,828
Tourist pensions	276	123	215	293	1,492	6,008	7,443	6,153	6,102
Agritourism pensions	3,501	4,158	4,686	4,358	8,210	40,046	40,510	35,583	37,521

Night spending in hotels as regards foreign tourists from 2008 to 2018 highlights surprising evolution in 2013, when the highest number of tourists was recorded – 74,891. After the year 2013 the number of nights spent in hotels decreased and only in 2018 there was another increase to 61,245 foreign tourists.

Table 52. Nights spent in accommodation facilities (number of tourists) in the Danube Delta area, Tulcea city included
Source: NIS data

	Years										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total	**174,355**	**124,341**	**108,705**	**130,519**	**133,797**	**191,329**	**125,416**	**138,177**	**149,798**	**210,334**	**371,797**
Romanians	142,451	94,565	84,791	95,395	87,493	116,438	97,318	104,362	110,480	157,514	310,552
Foreigners	31,904	29,776	23,914	35,124	46,304	74,891	28,098	33,815	39,318	52,820	61,245

During the months of May – September there is the highest number of tourists, representing 81.45% of the total number of tourists for the entire year (2019). Thus, the seasonality of the tourist attraction is taking shape, between May and September, when an average of 137,172 tourists arrive (according to data from the National Institute of Statistics). The peak was recorded in August, 24.21% of the total number of tourists, i.e. 40,773 people. Instead, in the months of January-February and December, records the fewest tourists, the three months gather a total of 7,387 tourists, which represents only 4.39% of the total number of tourists.

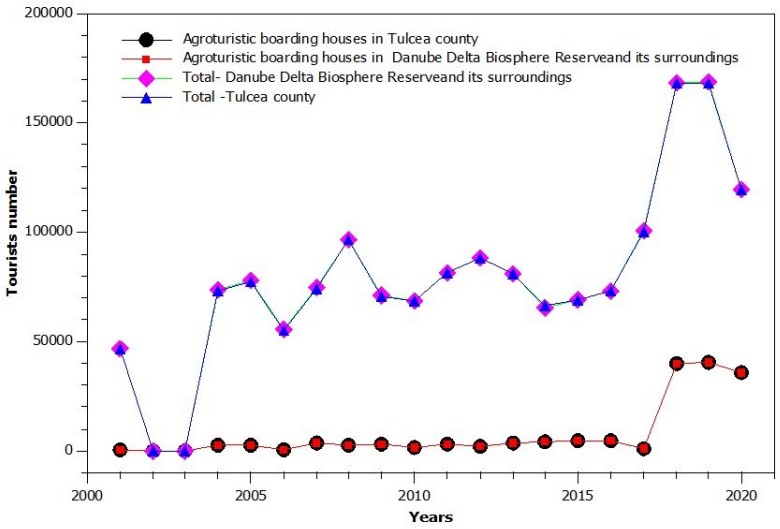


Figure 197. 20 years evolution of tourists' number in the Danube Delta and Tulcea County

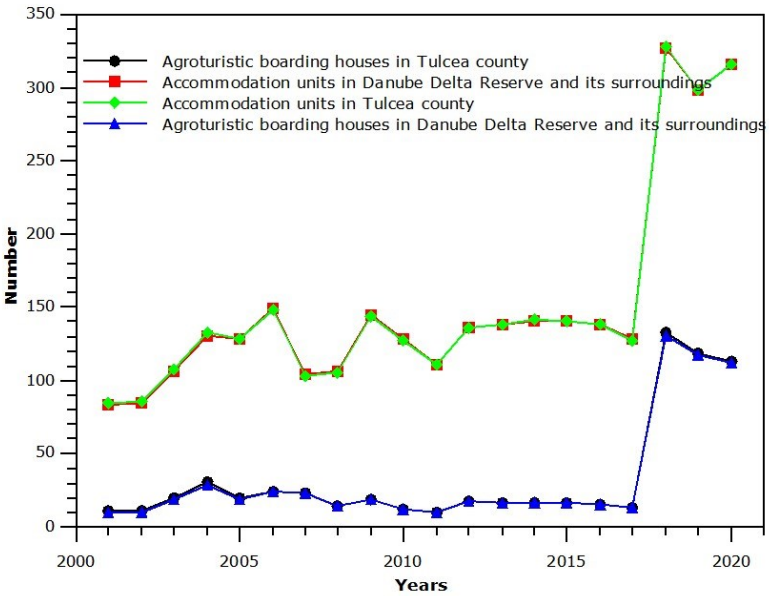


Figure 198. 20 years evolution of touristic accommodations by type in the Danube Delta and Tulcea County

As conclusion, the tourist activity in the case study is an important mean towards economic development, incomes and jobs. An important aspect that must be analysed in relation to tourism, is the very close connection with the environment. Danube Delta landscape is constantly reshaping by natural processes but there is no doubt that landscape degradation can be negatively influenced by practicing tourism, in general, in the perimeter and the proximity of the protected areas.

A study conducted by Babes-Bolyay University in Cluj, published in the scientific magazine RISCURI ŞI CATASTROFE, NR. XIX, VOL. 25, NR. 2/2019 states that the circulation of vessels that do not correspond to the ecological standards may cause erosion to the banks covered by riparian vegetation, because of their speed and the generated waves, the water pollution through releasing fuel waste and the phonic pollution, the latter affecting the aquafauna in the main. Aquatic transportation means with a relatively minor impact on the aquatic ecosystems are the rowboats for utilitarian or leisure purposes, wooden rafts canoes or kayaks, as preferred transportation means.

Also, particularly harmful are the effects of certain practices that go against the principles of public use of those transportation means, as well as organizing noisy picnic events, abandoning the waste that in the Danube Delta is carried away by the water circulation along brooks, channels and the three branches of the Danube: Chilia, Sulina and Sfântu Gheorghe. techniques and materials – harpoons, gas tanks for diving etc.; hunting through chasing / observing from a small distance is very harmful, especially during the breeding and growing periods; as for hatching, if eggs are abandoned by parents and may become pray for consumers, nestlings left alone for longer times may leave their nests and fall victims to predators.

Amateur fishing / hunting must observe the areas stipulated by the Danube Delta Biosphere Reserve Administration, the intervals of prohibition, hibernation and migration. Feeding certain species from the autochthonous fauna is also not recommendable because of the negative effects it may induce: domestic waste and various wrapping abandoned by the tourists may hurt the birds or animals and affect their health.

A negative impact on the strictly protected areas within the Danube Delta Biosphere Reserve is that of the loose or abandoned domestic animals, pigs, cattle and horses that have become semi-savage, after having left autochthonous human settlements. Knowing the impact of tourism on the environment through the summing- up of all the positive and negative impacts imposes the preservation of the ecological balance, avoiding to overstress the natural resources and observing periods of regeneration. In the latest 20 years, the impact of tourism on the environment has determined the emergence of novel concepts in materializing the relationship between the tourist potential and the degree in which the latter is turned to good account, i.e. ecotourism. At the same time, ecotourism is a practical concept, with an educational feature that mostly imposes respect for nature and awareness of tourists and the local communities for the values withheld by nature and not only. The development of tourism must be ecologically sustainable, economically viable and profitable and ethically and socially fair for the local community.

The tourism-environment relationship is vital, since the protection and preservation of the environment is the key condition for tourism to exist and develop. This connection is a complex, bidirectional one. The natural environment, through its components is one of the basic resources of tourism and on the other hand the tourist activity has both a positive and a negative influence on the ecological balance, however dangerously fragile in the Danube Delta, modifying its structure and eco-systemic functions.

The impact on the original/natural Danube Delta has also been determined by the numerous anthropic interventions that have begun with constructing the maritime navigable way along the Sulina branch, has continued with the channels dedicated to the circulation of the water in the watery complex and with the works dedicated to the reed surfaces – later abandoned, continuing with the works dedicated to agriculture, pisciculture and forestry. All these interventions have reduced the area of the natural

landscape by 30% of the Danube Delta surface, rendering poorer the biodiversity patrimony unique and unequalled in Europe.

Ecotourism is a form of tourism emerged in step with the need of the humans to retreat in nature and to visit and get acquainted with the natural areas protected or not by a national or international protection statute. Ecotourism stands apart from the other forms of tourism through a tighter and more direct connection with the natural and cultural-historic environment.

When integrated within the sustainable development, ecotourism implies activities destined to directly contribute to the protection of nature and the unaltered preservation of the ancient human creation.

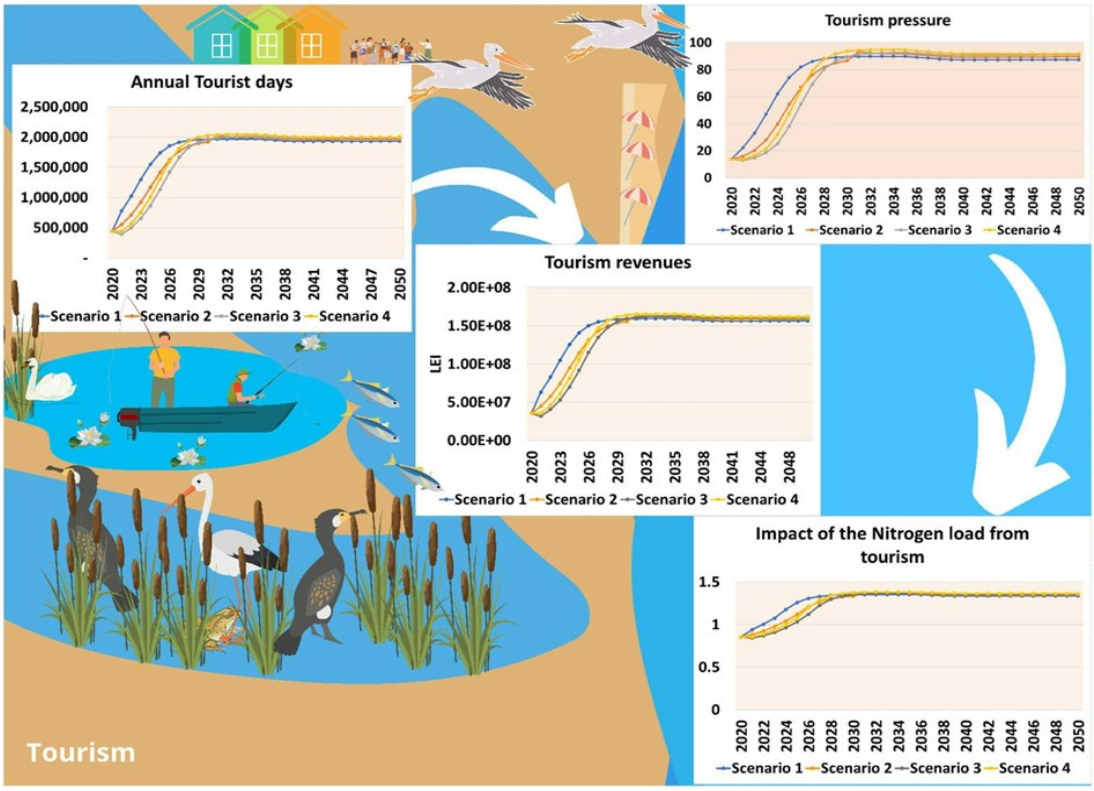


Figure 199. Tourism's KPI change in different scenarios in the Danube Delta. Source MDPI[63]

○ Industry and commerce

The most important industrial enterprises are located in developed urban centers (Tulcea, Babadag, Isaccea, Măcin and Sulina) and in some rural settlements (Niculițel, Topolog, Mihail Kogălniceanu, etc.), producing mainly: fishing trawlers, bed-ware, alumina and ferroalloys, firebricks, furniture, timber, clothing, canned fish, meat and milk products, alcoholic beverages, bakery, etc. In Tulcea county, 10 quarries were authorized for the construction rock exploitation in Măcin, Greci, Turcoaia, Cerna, Bididia, Somova, Isaccea, Luncavița, Denistepe and Bașchioi.

The growth trend of the industrial sector is noticeable at the turnover level, the value index of the turnover in the industry for 2021, compared to the index from 2013 is more than 240%. There was a sharp decrease of -10% in 2017, compared to 2016, a year characterized by heavy floods that affected 20% of the Danube Delta communities.

[63] https://www.mdpi.com/journal/water/

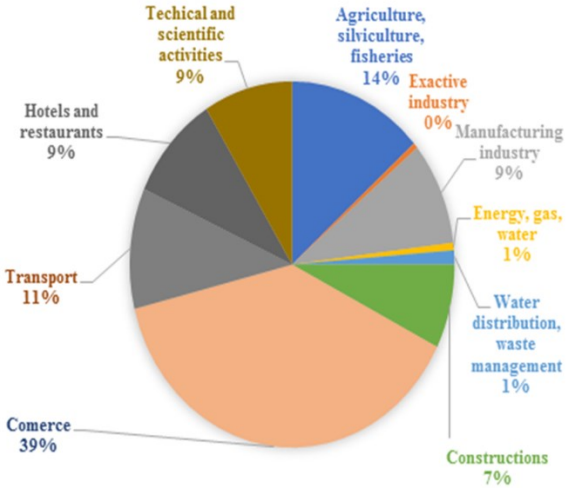


Figure 200. Companies in Tulcea region according to main national economical accounts Source: Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development

Table 53. Turnover, gross investments and personnel of active local companies in industry and commerce

	Years								
	2013	2014	2015	2016	2017	2018	2019	2020	2021
Turnover from active local companies [mil. €]	**5,489**	**5,848**	**5,954**	**6,826**	**6,335**	**9,401**	**9,820**	**10,429**	**13,214**
Extractive industry	86	65	110	95	81	88	117	154	155
Manufacturing industry	2,176	2,094	2,460	2,000	2,132	2,909	2,944	3,115	3,827
Production of electric and thermal energy, gas, hot water and air conditioning	138	96	133	192	253	410	641	739	992
Wholesale and retail trade, repair of motor vehicles and motorcycles	2,421	2,586	2,690	2,960	3,745	4,381	4,353	4,618	6,076
Gross investments from active local companies [mil. €]	**842**	**527**	**668**	**466**	**601**	**658**	**1,071**	**1,088**	**1,366**
Extractive industry	12	1	2	3	5	18	9	10	17
Manufacturing industry	235	243	154	160	229	212	313	162	326
Production of electric and thermal energy, gas, hot water and air conditioning	230	20	21	25	26	52	272	348	308
Wholesale and retail trade, repair of motor vehicles and motorcycles	88	98	80	109	90	179	204	214	236
Staff from active local companies [pers.]	**30,877**	**30,536**	**30,873**	**29,378**	**30,243**	**30,244**	**30,863**	**30,109**	**31,095**
Extractive industry	478	309	407	327	330	228	247	362	362
Manufacturing industry	11,958	12,542	12,120	10,486	11,126	10,576	11,232	10,861	10,839
Production of electric and thermal energy, gas, hot water and air conditioning	410	410	383	379	337	341	361	338	321
Wholesale and retail trade, repair of motor vehicles and motorcycles	7,280	7,080	7,461	7,275	7,476	7,898	7,506	7,327	7,229

The most productive sub-sectors of the extractive and processing industry are: the manufacture of bread, the manufacture of cakes and fresh pastry products; manufacturing of metal constructions and

component parts of metal structures; electricity production; manufacture of other articles of clothing; construction of ships and floating structures; manufacture of other wooden products, etc.

7.1.2. Climate change factors analysis: adaptation and mitigation baseline

To evaluate the mitigation baseline in Tulcea case study, the Emissions Database for Global Atmospheric Research (EDGAR[64]) was used. Data, cover specific sectors for the Sud-Est region of Romania being grouped into seven categories: agriculture, power industry, buildings, waste, transport, other industrial combustion and others. In addition, a downscaling process using the population was applied to obtain results for Tulcea case study. For Tulcea, we have emissions data for 2002, 2011 and 2021 according to available population inventories. The evolution of the emissions in Sud-Est region is presented in Figure 201. The total emissions value for Tulcea is presented in Figure 202.

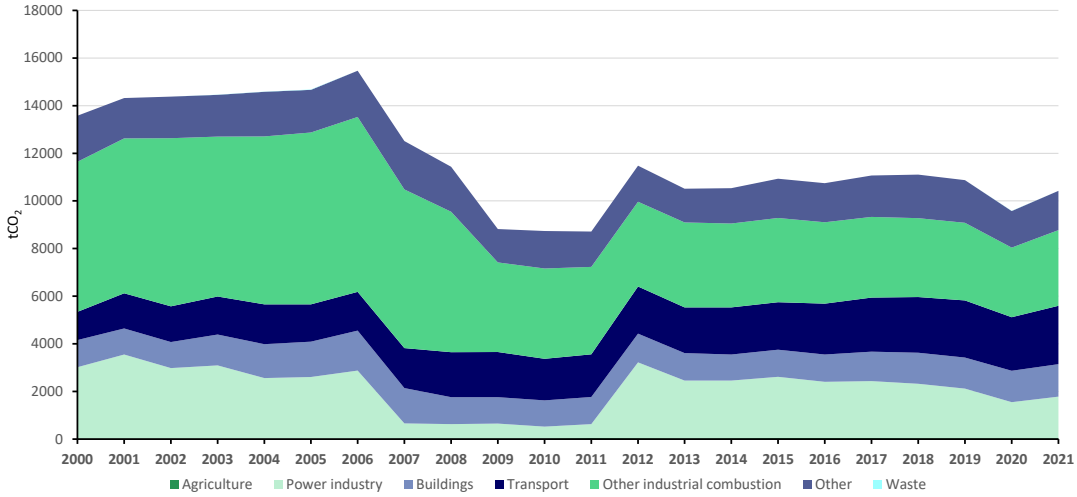


Figure 201. Evolution of CO_2 emissions in Sud-East region of Romania between 2000 and 2020. Source: Own calculation based on EDGAR data.

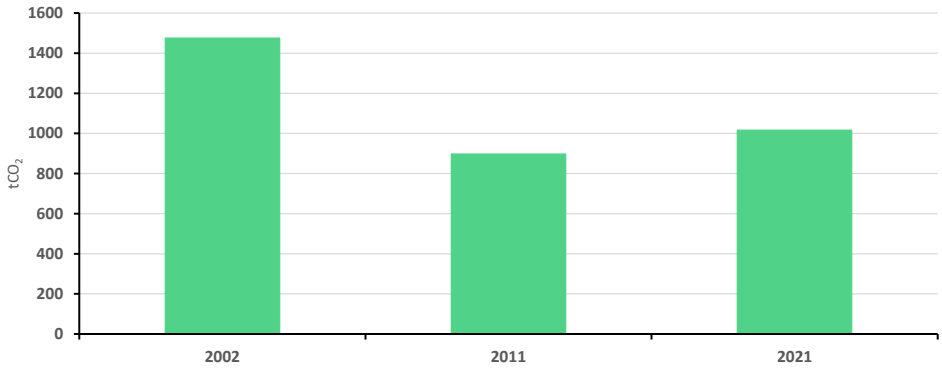


Figure 202. Evolution of CO_2 emissions in Sud-East region of Romania between 2000 and 2020. Source: Own calculation based on EDGAR data.

Considering the results presented in the figures, it is necessary to highlight the decrease in emissions in the last 10 years respect to 2000. The power industry join industrial combustion are the main principal CO_2 emitters in the case study followed by other that are close to buildings in emissions levels. Transport is also relevant according to their emissions level being waste emissions residual in the Sud-east region. Although the emissions have been reduced by about 30% since 2000, it is necessary to

[64] https://edgar.jrc.ec.europa.eu/

highlight the need to continue with the implementation of measures to reduce the emission levels starting from the combustion in the industrial sector. Al a local level, is also relevant to consider the role of transport and building to reduce the current level of emissions.

To complement the emissions analysis, the carbon stock in vegetation and soil in provided (Figure 203) using geolocated data from ESA Biomass Climate Change Initiative[65] and Global Soil Organic Carbon Map (from FAO)[66], on soil organic carbon and biomass stock that was translated in carbon stock using default values provided by the IPCC. As a result, the carbon stock in soils is higher the 635,653.85 $MgCO_2$, while the carbon stock in the biomass increases to 10,425,937.44 $MgCO_2$. The evolution of carbon stock in biomass along the year with available data is represented in Figure 204. It is observed how the carbon stock in the biomass has been reduced in a very visible way since 2010.

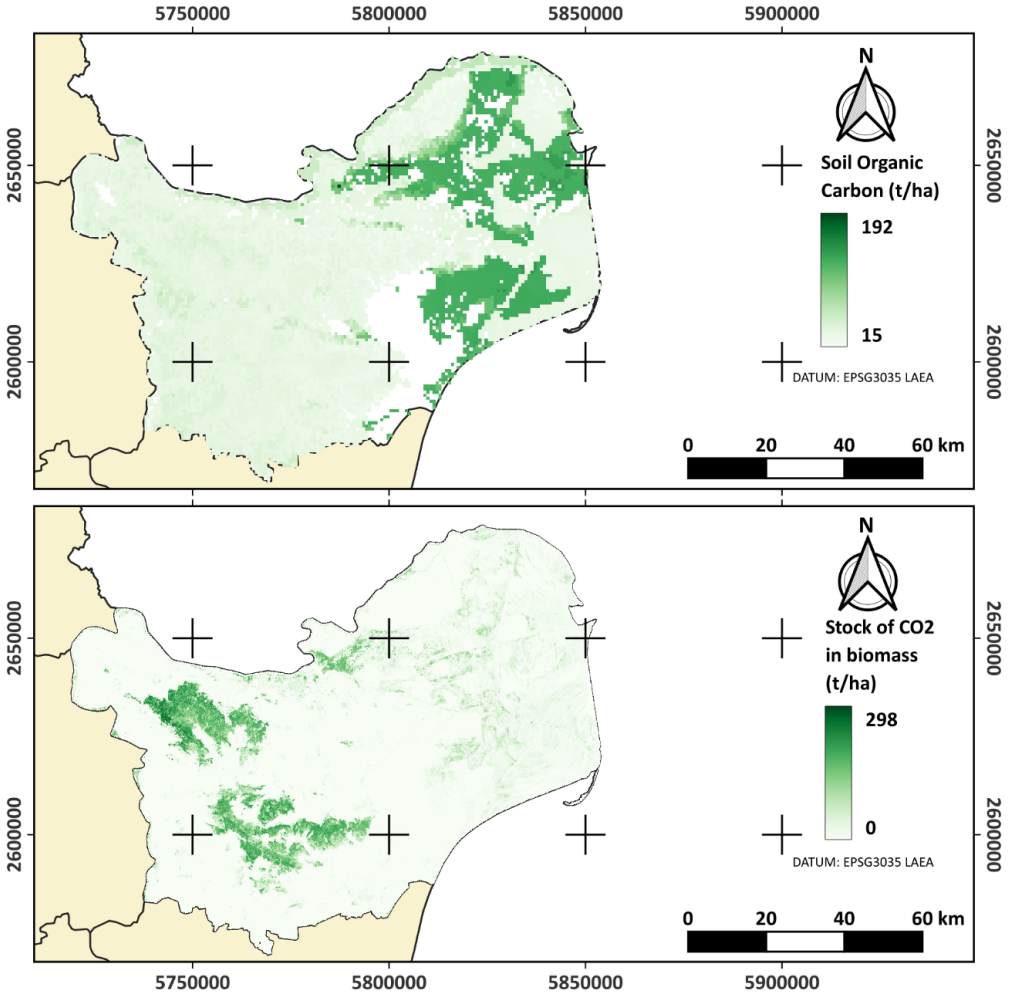


Figure 203. Carbon stock (tCO2) in soils (top) and carbon stock (tCO2) in biomass for Danube Delta in the reference year. Source: Own calculation based on ESA Biomass Climate Change Initiative and Global Soil Organic Carbon Map (from FAO) data respectively.

[65] https://data.ceda.ac.uk/neodc/esacci/biomass/data/agb/maps/v4.0
[66] https://data.apps.fao.org/glosis/?share=f-6756da2a-5c1d-4ac9-9b94-297d1f105e83&lang=en

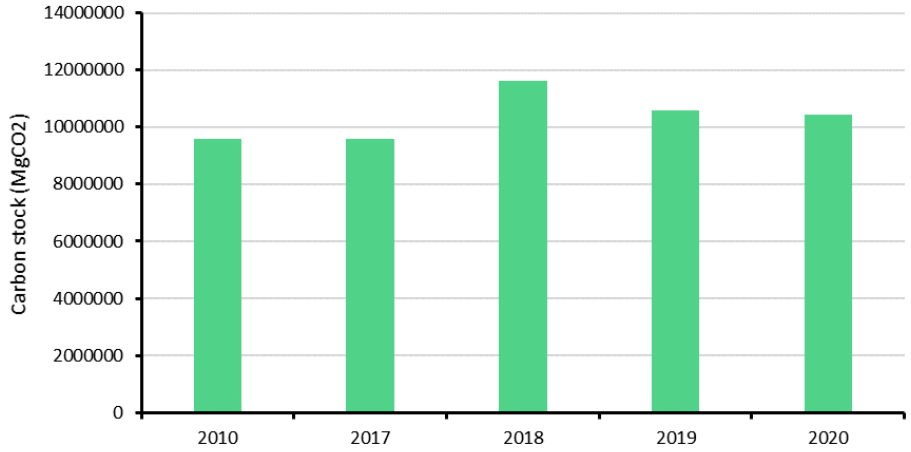


Figure 204. Carbon stock in biomass ($MgCO_2$) for Danube Delta between 2010 and 2020. Source: Own calculation based on Global Soil Organic Carbon Map (from FAO) data.

7.1.3. Past experience and legal framework analysis

For the past experience and legal framework analysis of Tulcea Case Study, 11 key documents were identified and further analysed, as all of them were considered of great relevance for the characterisation of the case study.

The detailed information of this analysis can be consulted in Annex 5 in section 11.9. The following Table 54 includes the relation of those documents analysed deeply and few key aspects on them. This legal framework will help to define the starting point for policy implementation considering the most important sectors and the associated climate change impacts.

Table 54. Relevant documents analysed for CS5 Wetland - Tulcea

#	Name of the document	Type	Scope	Year	Main sectors
1	**National strategy on adaptation to climate change for the period 2022-2030 in the perspective of 2050 (SNASC)**	Strategy	National	2022	• Energy • Cities and urban planning • Industry and commerce • Water and waste • Agriculture, forestry and fishing
2	**Romania's energy strategy 2022-2030, in the perspective of 2050**	Project	National	2022	• Energy
3	**Romania's national action plan in the field of energy efficiency**	Plan	National	2016	• Energy
4	**Romania's Strategy for Sustainable Development 2030**	Strategy	National	2018	• Biodiversity and natural heritage
5	**The integrated strategy for sustainable development of the Danube Delta**	Strategy	Local	2016 (& 2020)	• Agriculture, forestry and fishing • Biodiversity and natural heritage • Cities and urban planning
6	**National disaster risk management plan**	Policy	National	2020	• Cities and urban planning
7	**The national strategy regarding social inclusion and poverty reduction for the period 2022—2027**	Strategy	National	2022	• Society

#	Name of the document	Type	Scope	Year	Main sectors
8	**Climate change and environmental education in sustainable schools**	Other	National	2022	• Society
9	**The strategy for the consolidation and development of the General Inspectorate for Emergency Situations for the period 2016-2025**	Law	National	2016	• Society
10	**The National Strategy regarding the Circular Economy**	Policy	National	2022	• Finance, Economy • Biodiversity and natural heritage
11	**Strategy for sustainable transport for the period 2020-2030**	Strategy	National	2008 (& 2019)	• Transport

7.2. PESTLE results for the local ecosystem drivers' analysis

This section discusses how the impact of climate change, and adaptation and mitigation policy implementation are affecting the Tulcea region based on political, economic, social, technological, environmental and legal factors. Table 55 below provides details of the key items collected for each PESTLE factor. The sources for the information provided in the table are from the data collection results which came from the different exercises with stakeholders, the case study leader and supporter to identify the main drivers and the data sources to understand the local ecosystem (reported in section 11.10 Annex 10. Case Study 5 – Wetland (Tulcea): PESTLE results for the local ecosystem drivers' analysis). The process to complete this PESTLE was explained in the methodological part of this document (section 2.2).

Table 55. Results from Tulcea PESTLE analysis.

Factors	Category	Details	Impact status
Political	Governmental policy	Urban plan ▪ NATURE 2000 regulations ▪ Developing a Climate Adaptation Strategy ▪ Sustainable strategies	Positive
	Environmental policy	Land-use plan ▪ Strategy for the Development of the Danube Delta ▪ Policies for wild beaches and virgin forest protection	Positive
	Funding grant/initiatives	Local actors with expertise in energy efficient technologies and climate change adaptation ▪ Protected local gastronomic products ▪ access to European funding to local strategies	Positive
Economical	Economic growth	Policies in real estate ▪ Flexibility of the market	Positive
	Economic investment	Investors in renewable energy ▪ Investment of institutions.	Positive
	Financing capabilities	Payment for producing electricity	Positive
	Disposable income	Integrated Territorial Investment Instrument	Positive
	Taxes and loans	Less interest on loans for investments on climate change measures ▪ No taxes for environmentally friendly occupations	Positive
Social	Population growth	Low population density	Negative
	Health	Promotion of a healthy lifestyle and the well-being ▪ Free vaccination	Positive
	Trends	Initiatives to decarbonize the transport system ▪ People awareness of bad environmental practices.	Positive
	Transport	Infrastructure for electric cars ▪ Decarbonisation of the transport	Positive
	Tourism	Multiculturality and cultural activities ▪ Historical vestiges ▪ Promotion of local occupation.	Positive
	Project and initiatives	Fire awareness ▪ Brand for the horses ▪ Involve of groups actively on the strategies ▪ Food for children ▪ Partnerships with the eco-museum ▪ No-Car Fridays ▪ Social inclusion strategy.	Positive
Technological	Biodiversity	Monitoring wild animals ▪ Control of invasive species	Positive

Factors	Category	Details	Impact status
	Local stakeholders	Research on climate change adaptation/mitigation ▪ High qualified work and logistics in agriculture ▪ Interest on IT&C solutions.	Positive
	Research centres	Danube Delta National Institute ▪ Technical University Centre in Galati	Positive
	Energy and industry	Renewable electric energy ▪ Industrial Platform	Positive
Environmental	Emissions	Boats with electrical engines ▪ Zero-carbon certifications.	Positive
	Regulations/projects	Protection, conservation and development of forest ▪ Regulatory and control institutions for environment protection.	Positive
	Positive business	Collaboration between Tulcea Prefecture a Governmental environment association (AFBRD)	Neutral
	Efficiency	Production in photovoltaic panels ▪ Wind energy	Positive
	Biodiversity	Natural landscapes ▪ Migration of exotic birds.	Positive
Legal	Health and safety	Consumer rights-oriented law ▪ Hunting and fishing legislation.	Positive
	Equal opportunities	Law for gender equality and non-discrimination	Positive
	Future legislation	Incentives for the "prosumers" ▪ Regulation of horse, cows and pig farms.	Positive
	Environment	Law for the protected areas ▪ Environmental Impact Assessment.	Positive
	Institutions	Decentralization. ▪ Inspection, approval and control competences. ▪ Control of the acts emitted by local authorities	Neutral

Sustainability requires an integrated approach covering the social, economic, environmental and technological environment. If we consider the **political factors**, we can see the relevance of plans, strategies and policies as factors that help to stimulate the adoption of measures to reduce the impact of climate change through the reduction of emissions and the improvement of adaptation to climate change. Initiatives and incentives to promote renewables and protect biodiversity can also be key to contribute to the sustainability of the region, its resilience and decarbonization. It is necessary to highlight mechanisms that incentive sustainable practices as the *Danube Delta Integrated Territorial Investments*, which was the financial instrument available to Tulcea County during the 2014-2020 period, allowing the implementation of projects funded under different operational programs in a cross-sectoral and spatial manner.

If we analyze the **economic factors**, investment in renewable energy and in the less cost of climate change measures, can serve to guide the population's capacity to become climate aware and advance in the decarbonization of the region's economy through the improvement in the use of local renewable resources. It must be considered that the GDP per capita in 2020 was 9,100 €, highlighting its increase of 2.2% compared to the previous year. Its value had been increasing and in 2019, its value was 8,900 €. The regional GDP value is significantly lower than the national average (11,400 €), which may be an indicator of the need for incentives for the population to implement measures or invest money in training and environmental awareness so that the population becomes aware of climate change. Due to the Danube Delta Biosphere, tourism and agritourism activity in Tulcea county has a big importance, and it is considered as one of the biggest incomes of the region.

Social factors in the region of Tulcea are influenced by the population, its evolution and the inequality aspects. The population has increased slightly in recent years, reaching 193,355 inhabitants in 2021 (1st of January), which represents a decline of 4% compared to 2011 census. Its distribution between men and women is equitable (50%). This decline is due to negative vegetative growth, there are more deaths than births, and it is a low birth rate. In addition to the migration rates that cause population fluctuations to be conditioned by the population poverty and food availability, related to work opportunities. At country level, the Gini coefficient was 0.32 in 2022 being the lowest value in the series of years 2011-2022. This value could be similar to the regional due to the similarity between socio-economic indicators at national and regional level. It is necessary to point out that the higher income inequality in a country or a region, the lower is the level of social trust. In addition, the higher economic development, the higher is the level of social trust. More than the 25% of the population

was at risk of poverty in 2015[67]. The promotion of actions, projects and initiatives in the region is essential to improve the population's awareness of the reality of climate change.

Technological factors consider the role of technology as a driver to guide adaptation and mitigation against climate change in the region. Tulcea has the Danube Delta National Institute, and this region is close to the Technical University Centre in Galati. These two centers guide the research, development and innovation activities in the region. With great interest in biodiversity, energy efficiency, renewable energies, agriculture, mitigation and adaptation to climate change, and ICT solutions. The research activities are supported by local stakeholders and its knowledge, through the participation in initiatives, projects and consultations in the formulation of laws, strategies and plans. Research investment is key to cover relevant aspects as water safety. In this sense, the Romanian government invested 245 Million € for water and sewage systems in 2022. This budget will allow to over 35,000 residents water supply and to 53,000 access to sewage system.

Regarding **environmental factors**, initiatives and laws to protect endemic fauna and flora, and also the natural landscapes being key to ensure Danube Delta conservation. In addition, the forest protection and conservation figures are crucial to guide biodiversity and ecosystems protection. There are also actions to become a zero-carbon county, like certifications or the implementation of renewable energies (e.g. wind and PV panels) to improve the mitigation capacities of the region. The deep research on policies developed in this deliverable pointed out are several initiatives and strategies implemented in the region that seek to improve its sustainability and its adaptation to climate change. This gives us information about the interest and commitment of the regional and local authorities in following the decarbonization guidelines established at the European level.

Finally, **legal factors** must be analyzed, directly related to the legislative framework and regulations to improve the adaptation or use of resources. We must highlight the initiatives to protect both the environment and energy, or the fight against social inequalities (food and water accessibility) and gender parity. Above all, we must highlight the relevance of environmental impact assessments laws joint laws for protected areas as key drivers to ensure Danube Delta sustainability. Also, the fauna management laws, including hunting, fishing and livestock are crucial for the biodiversity conservation. In addition, we must highlight the relevance of a change and increase in control of the competency system in administrations to promote the equity in law implementation.

7.3. Summary of case study characterisation in Danube Delta

Danube Delta has a particular importance than other areas of Romania, due to its geographical position, its natural resources, its ethnic and cultural diversity, as well as its recognized economic and tourism potential. According to the climate and weather analysis under historical conditions and the projection to a future period, the mean annual daily temperature will increase (around 5.3 ºC according to the most unfavourable scenario, being higher than 17ºC by 2100). The precipitation in the future, will slightly decrease according to the data from climate models, with a reduction of up to 12% in the annual precipitation according to the most unfavourable scenario. On the other hand, the maximum annual daily cumulated precipitation increases in all evaluated periods, which could be translated in torrential events as was previously mentioned.

This climate trends affects also the key vulnerable sectors in Tulcea County, identified by case study leaders and supporters, as well as considering also the view of the local stakeholders. These are the agriculture, energy, water, tourism and industry sectors.

As the economic development of the region is highly influenced by the existence of the Danube Delta Natural Reserve in the immediate neighbourhood, the agriculture sector should comply with the

[67] https://www.espon.eu/sites/default/files/attachments/country%20fiche%20Romania_en.pdf

environmental restrictions from that legislation on protected areas. Agriculture is the main economic activity in the south-east region. The vegetal sector is characterised by extensive production system, dominated by cereal cultivation. Livestock sector is poorly represented in the Tulcea county, with only two pig intensive farms. Fish farming in a strong point of the economy, due to the large surface areas of water, although in the recent years they are suffering a decrease in production.

Energy is a profitable sector in terms of productivity. The main electricity supplier in the county operates the network with 120 transformer stations. In addition, Dobrogea is considered one of the most promising regions in Europe in terms of wind potential, while also having a favourable relief for the wind industry. So far, 83 parks have received environmental approval, and the total number of turbines that can be built in that area is 839.

From a hydrographic point of view, the region has 115 bodies of surface water under the categories of natural, heavily modified and artificial rivers, natural lakes, reservoirs, and transitional waters. The surface of the Danube Delta includes the three branches: Chilia, Sulina, Sfântu Gheorghe, which represent major arteries. The hydrological regime of the Danube in the lower course is considered relatively uniform due to the ratio between the minimum flow and the maximum flow of 1/10. An important role in the ecological status of deltaic ecosystems is played by the liquid flow entering the lakes and canals of the lake complexes and the stagnation period during the year.

In Tulcea county there are 49 protected natural areas of national interest. Danube Delta is the only delta in the world declared a biosphere reserve, so it is a true "living museum" of biodiversity that includes 30 types of ecosystems, 5,137 species of which 1,689 species of flora and 3,448 species of fauna, as well as it is one of the largest areas' wetlands in the world, ideal habitat for waterfowl. So, it is not a surprise that the tourism in the county is mainly related to nature, although there is also interest on archaeological remains, historical monuments of architecture and art, museums and cultural sites, monasteries and others that complement the touristic potential of the protected natural areas. Tourism sector has increased in the recent years, especially after 2013, and it is a seasonal tourism, mainly in summer period (between May and September).

Industry sector is an important productor of fishing trawlers, bed-ware, alumina and ferroalloys, firebricks, furniture, timber, clothing, canned fish, meat and milk products, alcoholic beverages, bakery, etc. Also, 10 quarries were authorized for the construction of rock exploitation. It is noticeable the growth trend of the sector, with an increase of more than 240% between 2013 and 2021.

The adaptation and mitigation baseline have been analysed as well, and the emission levels present a large decrease in the last 10 years with respect to 2000. Power industry and industrial combustion are the main CO_2 emitters in the region, followed by buildings. Transport is also relevant in terms of their emissions level, being waste-emissions residual in the south-east region. The carbon stock in vegetation and soil can be highlighted, especially the capacity for carbon stock in soil and biomass (although it has been reduced since 2010).

The analysis of past experiences in Tulcea county focused on 11 key documents, including the National strategy of adaptation to climate change, Romania's energy strategy 2022-2030, Romania's national action plan in the field of energy efficiency, integrated strategy for sustainable development of the Danube Delta, the National disaster risk management plan, the national strategy regarding social inclusion and poverty, National strategy on Circular Economy, among others.

In accordance with the Local Council of Stakeholders of Tulcea case study, the drivers considered as enabling factors for climate change policies implementation were analysed through the aspects of a PESTLE analysis. Among them, the following can be outlined: local and regional sustainable strategies, integrated territorial investment instrument for local funded actions for ecological business models, public partnerships with the local eco-museum to promote green practices, growing number of green initiatives, social inclusion strategy for vulnerable citizens, Danube Delta National Institute launches

great public campaigns to promote new technologies, environmental studies and climate change solutions, close presence of the renewable source energy production, highly qualified work forces and logistics in agriculture, specific legislation for protected areas, access permits in the protection areas, favourable area for renewable energy production (especially wind and solar).

8. Socio-economic and environmental issues and next steps

The socio-economic aspects have been evaluated throughout all the sectors under study, placing emphasis on key aspects such as the evolution of the population or the economy. All the inputs collected from the PESTLE analysis (external factors to the system that have influence in the decision-making) and the results of the characterization of each case study considering the analysis of the sectors, the climate and the initial policy framework, will be of great interest to define and characterize impacts in future stages of the project. In this way, the socioeconomic context of the most vulnerable sectors, will consider the variables and limits that could have large climate impacts in each case study, the key economic sectors and the cascading effects.

The PESTLE results will help to identify and create a real idea as wide as possible of the environment in which the case study is running, so that we can make the best decisions to successfully adapt to climate change effects. It is necessary to highlight that sustainability requires an integrated approach covering the social, economic, environmental, legal, political and technological environment to deliver insights under a holistic approach. Deliverable 2.2 (Analytical framework for socio-economic factors) (D2.2) provides a set of useful indicators to evaluate the socio-economic context of each case study, guiding the assessment in Task 6.3 of NEVERMORE project. These indicators joint the identified drivers are key to evaluate the impacts due to climate change and policy implementation. The following indicators from D2.2 (Table 56) were identified as the most relevant to guide this socio-economic assessment in the modelling initiatives of NEVERMORE project.

Table 56. Set of relevant indicators to guide socio-economic analysis.

Topic	Indicator	Description of indicator
Behaviour Change	Risk perception	Perceptions about threats through climate change and environmental catastrophes and how likely they are or will be prevented.
Behaviour Change	Environmental Norms and Values	Environmental norms and values as an indicator cover different manifestation of morals, social norms, and values related to the environment. Under this indicator, we subsume different dimensions of norms and values often treated as different concepts in research: biospheric value orientation – the extent to which a person considers costs and benefits for the environment (ecosphere, biosphere); environmental identity - whether a person identifies as an environmental person and feels like they belong to other people or to the group of pro-environmentalists because identity determines behaviours; personal moral obligations to behave pro-environmentally; and perceived environmental norms - Whether a person thinks that the people around them endorse pro-environmental norms.
Provisioning Factor	Decent work	SDG 8 (1) NEETS = people (age 15-29) neither in employment nor in education nor training by gender (2) long-term unemployment rate (>=12 months) age: 15-74; (3) employment-rate by citizenship (EU/non-EU) age (20 – 64)
Provisioning Factor	Gender equality	SDG 5 + SJS EIGE gender equality index based on 31 gender equality indicators in the realms of work, money, knowledge, time, power and health
Provisioning Factor	Income equality	SDG 10 + considered as provisioning factor by Vogel et al. 2021 (1) Gini coefficient of equivalised disposable income (2) The ratio of total income received by the highest-earning 20% of the population to lowest-earning 20% (3) purchasing power adjusted to GDP per capita by NUTS2 region
Resilience and Vulnerability	Confidence in national institutions	A person's confidence in national political and state institutions
Social Priorities	Absence of energy poverty	SDG 7 + SJS inverse of population with poverty status unable to keep household adequately warm

Social Priorities	Basic education	SDG 4 + SJS (1) early leavers from school and training (2) share of population with primary education as highest level of educational attainment
Social Priorities	Drinking water access	SDG 6 + SJS. Share of people using safely managed drinking water services
Resilience and Vulnerability	Local infrastructure	People's access to infrastructure that improves their capacity to manage disasters
Behaviour Change	Environmental Policy Support	Being in favour of policies like emission taxes, government investments in renewable energies, etc.
Provisioning Factor	Public service quality	SDG 16 & considered as provisioning factor by Vogel et al. 2021 quality of public services, civil service, and policy implementation (score), calculated as Government effectiveness (rescaled to 1- 6)
Political System	Access to environmental information	Pillar 1 of the indicators to measure environmental democracy. Captures assessments of the right to freely access information on environmental quality and problems
Political System	Public participation in deciding environmental matters	Pillar 2 of the indicators to measure environmental democracy. Captures assessments of the right to participate meaningfully in decision-making.
Behaviour Change	Social trust	Trusting other people in society / social environment

The indicators provided in the table joint others as *demography, gender distribution, unemployment rate, GDP, income, area of residence (urban/rural) or healthy life expectancy* could be key to evaluate in an integrated perspective the social, economic, environmental, legal, political and technological environment of an area of interest. This initial list presented as part of the conclusions of this deliverable must be validated and/or expanded by the modelers.

Therefore, based on this characterization of the case studies and considering the needs of the evaluation of both modelling approaches, the case studies and the WILIAM model at national, EU and global scale, the results and indicators listed above must be analyzed prior to its implementation in the modelling framework at all scales. In this way, aspects of socioeconomic development that consider the main drivers identified by the stakeholders will be integrated into the models.

9. Conclusions

The report is a comprehensive characterisation of the five case studies of the NEVERMORE project, developed in collaboration between the case study leaders and supporters, as well as technical partners to carry out the most detailed analysis of the sectors, climate, policies and drivers that play a relevant role in the evaluation of the effects of climate change in the different regions of the case studies, in order to define feasible adaptation and mitigation pathways.

The methodology followed to the characterisation includes the analysis of vulnerable sectors, the current and future climate, the definition of the baseline in adaptation and mitigation, and the analysis of the legal framework that directly affects the identification and selection of the policies to be implemented in each case study. In addition, the methodology included a PESTLE analysis to identify the most relevant drivers considering the view of the stakeholders of each area through consultations.

From the analysis of the climate and weather under historical conditions and in projection to a future period, the mean annual daily temperature is expected to increase in around 5ºC for all the case studies in the most unfavourable scenario. Resulting in mean annual daily temperatures in 2100 higher than 24ºC for the CS Sitia, more than 10ºC for the Trentino CS, more than 7ºC for the Norrbotten CS, higher than 20ºC in the CS of Murcia, and more than 5ºC for the Danube Delta CS.

Key vulnerable sectors in each case study were pre-identified and then validated through consultations with the NEVERMORE Local Councils of Stakeholders through an activity of identification of challenges, sectors affected and priorities in their areas. The result is that agriculture, forestry and fishing sector is a key vulnerable one for four out of the five case studies (CS1, CS3, CS4 and CS5), water and waste is a vulnerable sector for four case studies (CS1, CS4 and CS5, and for CS2 as secondary priority), tourism, leisure and cultural heritage is a key vulnerable sector for all the case studies, for three of them with high priority (CS2, CS3 and CS5), and the other two as secondary vulnerable sector; biodiversity is a vulnerable sector for three case studies (CS1 and CS3 with high priority, CS2 as secondary), energy sector is vulnerable for two case studies (CS2 and CS5), and industry and commerce has a second priority as vulnerable sector for two case studies (CS4 and CS5).

Agriculture is a key economic sector for Sitia case study, with a great percentage of land areas cultivated, and the increase of temperature, the lightening of dry periods, decrease in precipitation, sea level rise in coastal agricultural lands, among other climate hazards, will affect this sector. Water scarcity is also a vulnerability in Sitia, due to drouths and affecting at the same time the key sectors of agriculture and tourism (as it affects people). Biodiversity has a high relevance for Sitia too, which counts with one of the most important environmental areas in the Mediterranean: Sitia's Geopark, with floral interest, hundreds of species, and large number of characteristic animals of the island. Finally, economy is also strongly dependent on tourism, that can be affected by climate and weather conditions change.

In Trentino, tourism and its related activities are mainstay of the local economy, very relevant in relation of the number of certified facilities and workers involved. It is largely affected by a marked seasonality of the tourism, as it is mainly related to ski and to enjoy the snow and fresh mountain temperatures in summer. So, climate hazards have a critical impact if temperatures are rising and there is not enough snow. Energy is also a key economic sector in the region, as there is an important share of renewable production: hydroelectric mainly (76%). Actually, electricity production exceeds consumption in the region, and it is a risk also related to tourism sector if more energy is spent in ski resorts and artificial snow production is needed. In relation also with both tourism and energy sector, the water sector is also a vulnerable one for Trentino, as per the water resources, which are part of the touristic attractive and hydroelectric generation. It also has a very extensive and articulated system of protected areas, with a 30% of its territory protected, which makes the biodiversity sector a vulnerable one, especially for the risk of biodiversity loss due to climate change impacts.

For the Norrbotten case study, reindeer husbandry is an important economic sector, especially for the Sami population, all reindeer in Sweeden are domesticated and they graze in forests and mountains. Forests, part also of the agriculture, forestry and fishing sector, are also relevant, as they cover 40% of the surface of the County. Tourism (nature-based) is a key sector for the case study too, very much linked with the other vulnerable sector of biodiversity, as for the national parks and nature reserves. Coastal and marine environments are unique in a European perspective, as the special climate and weather conditions create that special ecosystem, which would be largely affected by climate change. As secondary vulnerable sectors, both mining and energy should be considered. There are five (metal) mines, whose production is increasing. Renewable energy use is growing and hydropower accounts for nearly 90% of the electricity produced.

Murcia Region is 50% covered by agriculture, and 45% by forest which makes it a key vulnerable sector for this case study. Climate hazards impacts in the type of crops that can be cultivated and largely affect the production of this key economic sector, with important social implications as well (in employment, not only in the primary sector but in the other related subsectors too). The scarcity of water is also a great vulnerability in the region, very much related to the agriculture sector, as water limitation affects irrigated crops, besides domestic activities. In relation to agriculture, industry and commerce sector has also quite relevance in the region, mainly food industry. Last but not least, as Mediterranean area, tourism is also a relevant sector with high potential to attract visitors to the coast location and warm climate, affected especially by the temperature increase and sea level rise.

The economic development in Tulcea County is highly influenced by the Danube Delta Natural Reserve in the immediate neighbourhood, and the agriculture sector should comply with the environmental restrictions of that protected areas. Agriculture is the main economic sector, characterised by extensive production and dominated by cereal. Energy is also a productive sector, with great number of transformer stations in the region and high wind potential, which is translated in a big number of turbines and parks in the area. Water sector is relevant as well, the region has a lot of surface water bodies, mainly related with the Danube Delta. Danube Delta is declared biosphere reserve, so it is also important in an ecosystem point of view. It relates also with the biodiversity, including several types of ecosystems, species of flora and fauna, and for being one of the largest areas' wetlands in the world. Tourism sector is growing in relation to this unique ecosystem. Industry sector has also quite relevance, also in relation with an increasing in construction of quarries for rock exploitation.

10. References

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11. Annexes

In the following sections, two annexes devoted to each case study are depicted. The first one includes the complete list of identified relevant documents for the case studies (in a horizontal table with the fields for the initial high-level characterisation), and then, a section per each document analysed deeper, in the table template (adapted to the different document needs) as presented in section 2.1.3. The second annex for each case study includes the complete information gathered from the different activities related to the PESTLE analysis of the local ecosystem drivers (as presented in section 2.2).

- **Section 11.1:** Annex 1. Case Study 1 – Island (Sitia): Past experience and legal framework analysis.
- **Section 11.2** Annex 2. Case Study 1 – Island (Sitia): PESTLE results for the local ecosystem drivers' analysis.
- **Section 11.3:** Annex 3. Case Study 2 – Mountain Region (Trentino): Past experience and legal framework analysis.
- **Section 11.4** Annex 4. Case Study 2 – Mountain Region (Trentino): PESTLE results for the local ecosystem drivers' analysis.
- **Section 11.5**: Annex 5. Case Study 3 – Boreal region (Norrbotten): Past experience and legal framework analysis.
- **Section 11.6** Annex 6. Case Study 3 – Boreal region (Norrbotten): PESTLE results for the local ecosystem drivers' analysis.
- **Section 11.7**: Annex 7. Case Study 4 – Mediterranean Region (Murcia): Past experience and legal framework analysis.
- **Section 11.8** Annex 8. Case Study 4 – Mediterranean Region (Murcia): PESTLE results for the local ecosystem drivers' analysis.
- **Section 11.9**: Annex 9. Case Study 5 – Wetland (Tulcea): Past experience and legal framework analysis.
- **Section 11.10** Annex 10. Case Study 5 – Wetland (Tulcea): PESTLE results for the local ecosystem drivers' analysis.

11.1. Annex 1. Case Study 1 – Island (Sitia): Past experience and legal framework analysis

Table 57. Relevant documents identification of CS1 Crete Island (all of them part of the deeper analysis).

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
1	**National climate change adaptation strategy – Greece**	Strategy	https://ypen.gov.gr/wp-content/uploads/legacy/Files/Klimatiki%20Allagi/Prosarmogi/20160406_ESPKA_teliko.pdf	National	2016	• Water and Waste • Tourism, cultural heritage • Biodiversity and natural heritage • Agriculture, forestry and fishing • Energy • Transport	All sectors covered. This National climate change adaptation strategy (NCCAS), sets out the general objectives, guiding principles and means of implementing a modern effective and development adaptation strategy. It is a continuous and flexible process of planning and implementing the necessary adaptation measures at national, regional and local level and aspires to be the lever of mobilizing the potential of the Greek state, economy and society at large to address the impacts of climate change in the years to come.
2	**Crete Regional climate change adaptation plan**	Strategy	https://drive.google.com/file/d/1LLoI7Qn_fA96kFkeFKzReENagYHG_IgT/view	Regional	2021	• Water and Waste • Tourism, cultural heritage • Biodiversity and natural heritage • Agriculture, forestry and fishing • Energy • Transport	All sectors covered. It is the individual Crete's Regional Climate Change Adaptation Plan (CRCCAP), which are setting the next step in adapting to climate change, following the guidance and what is set in the NCCAS.
3	**National plan for increasing the number of nearly zero-energy buildings**	Plan	https://ec.europa.eu/energy/sites/ener/files/documents/greece_en_version_2017.pdf	Sectoral	2017	• Cities and urban planning	
4	**Civil Protection guidelines**	Guideline	https://www.sitia.gr/information-services/politprostsitia	Local	2020	• Society	Covers different climate hazards

The sections below include the detailed analysis of the relevant documents performed within the Sitia Case Study.

11.1.1. Annex 1.1. Deep analysis of document #1 and #2 of CS1

Table 58. Document #1 and #2 of CS1 Crete Island deeply analysed.

Case Study	**CS1 – Island Sitia, Crete Island (GR)**		
#1 & #2	**National climate change adaptation strategy – Greece & Crete Regional climate change adaptation plan**		
Type of document	Strategy	**Language(s)**	Greek, English
Scope	National, Regional	**Year of adoption**	2016, 2021
Web link	https://ypen.gov.gr/wp-content/uploads/legacy/Files/Klimatiki%20Allagi/Prosarmogi/20160406_ESPKA_teliko.pdf, https://drive.google.com/file/d/1LLoI7Qn_fA96kFkeFKzReENagYHG_IgT/view	**Target year**	2030
Brief description	This National climate change adaptation strategy (NCCAS), sets out the general objectives, guiding principles and means of implementing a modern effective and development adaptation strategy within the framework defined by the United Nations Convention on Climate Change, European Directives and international experience. NCCAS is the first step towards a continuous and flexible process of planning and implementing the necessary adaptation measures at national, regional and local level and aspires to be the lever of mobilizing the potential of the Greek state, economy and society at large to address the impacts of climate change in the years to come. NCCAS does not analyse in depth the necessary sectoral policies, nor does it decide on the appropriateness of individual adaptation measures and actions at local/regional level, nor does it attempt to prioritize the indicative measures and actions proposed. These issues are the subject of the individual Crete's Regional Climate Change Adaptation Plan (CRCCAP), which are practically the next step in adapting to climate change.		
Sectors involved	Water and waste	Tourism, cultural heritage	Biodiversity and natural heritage
	Agriculture, forestry and fishing	Energy	Transport
Main target addressed (#1)	**WATER**		
Other relevant objectives or strategies addressed			
O1	Sustainable management of the region's water resources in relation to agriculture.		
O2	Actions to assess the impact of climate change on the water resources of the Region of Crete.		
O3	Water saving and efficiency actions.		
O4	Promote the reuse of treated urban wastewater.		
O5	Development of activities and land use compatible with locally available water resources.		
O6	Integration of the impacts of climate change into the water management planning of the Region of Crete.		
O7	Actions to inform the public, public bodies, and enterprises about the impact of climate change on water resources and how to deal with them.		
O8	Knowledge and recording of the risks of climate change in the coastal zone of the Region of Crete.		
O9	Preparation and implementation of an integrated coastal zone management plan for the Region of Crete, incorporating climate change.		
O10	Risk prevention and response actions.		
Relevant policies and measures included			

P&M1	Encourage farmers to use less water-intensive and even dry crops (e.g., Incentives to farmers to implement closed hydroponic systems). Use of treated water from urban wastewater treatment plants in agriculture. Establishment of a regulation to manage the high concentration of salt in irrigation water in coastal agricultural areas (salinized underground waters) and in areas with increased salinity (gypsum waters).
P&M2	Development of a specific plan of measures to protect vulnerable aquatic systems for adaptation to climate change regarding the risk of unavailability of water resources (surface and ground) and mitigation measures. Implementation of a network to monitor the effects of climate change on the main groundwater bodies and reservoirs of the Region of Crete (development of a telemetric network for the continuous measurement of rainfall, level, and supplies in the most important water systems of the Region).
P&M3	Promote water saving in all sectors and uses (agriculture, tourism, industry, housing). Maintenance, repair, and modernization of the water supply networks of the Region of Crete. Development of "smart" networks and installation of "smart" hydrometers. Installation of low-water equipment in the public buildings of Crete. Incentivize the installation of adequate low-water equipment in private enterprises and in the domestic sector (e.g., provision of free equipment, subsidies, tax rebates, etc.). Optimization of existing surface water storage methods (e.g., dams) and new generation (e.g., tanks), if necessary, in particular by replacing pumps during low-flow or no-flow periods.
P&M4	Construction of new Sewage Treatment Plant (STPs) or upgrading of existing ones, so as to result with the treatment of water of suitable quality for irrigation of green areas and specific crops, for enrichment of Underground Water Systems (UWS) etc. Encourage the reuse of treated urban wastewater in agriculture, industry, tourism and the domestic sector.
P&M5	Control of aquatic activities, as a priority in areas with insufficient water resources, for possible measures implementation (e.g., large tourist facilities, water-intensive crops). Re-inspection licensed water abstractions in water bodies of the Region of Crete threatened due to climate change. Control of the exploitation of groundwater. Introduction of incentives and disincentives for the rational use of groundwater resources.
P&M6	River Basin Management Plans (RBMP), Masterplans, drought plans, water safety plans, etc. Establishment of a protection zone for significant groundwater abstractions.
P&M7	Information campaigns on the impact of climate change on water resources and best water-saving practices. Updates on the applicability of treatment and recycled water reuse methods to different uses. Encourage changes in consumption patterns and attitudes.
P&M8	Preparation of a study and drawing up a plan for the "Integrated Coastal Zone Management (ICZM) Management of the Region of Crete". Establishment of a mechanism for continuous monitoring of the coastal areas of the Region of Crete with emphasis on the most vulnerable areas.
P&M9	Set incentives to avoid residential and business development in coastal areas facing serious risks, up to and including a ban on land use (where necessary) in coastal areas threatened. Incentives to relocate existing actions of coastal areas at increased risk. Completion of limit line of the foreshore and beach.
P&M10	Examination of the necessity of gradual or immediate relocation of buildings and facilities from high -risk areas to safer areas, providing appropriate grants and incentives. Artificial vegetation cover along the coastline, artificial coastal replenishment, breakwaters, installation of bottoms, removal of river interventions where possible. Upgrading of existing projects, where appropriate. Priority to nature-based solutions (nature-based solutions) as well as to coastlines of interest for the tourism sector and for the protection of coastal ecosystems.
Main target addressed (#2)	**AGRICULTURE**
Other relevant objectives or strategies addressed	
O11	Monitoring of critical parameters to assess potential threats to the agricultural sector.
O12	Climate change risk management. Such disasters include damage from extreme weather events, e.g., high temperatures, drought, floods, sea level rise, etc.
O13	Establishment or improvement of existing systems of recording critical parameters based on new knowledge about the effects of climate change on the components of the productive system for livestock farming.

O14	Promotion to rural professionals, livestock farmers, the relevant bodies, and services of the Region of Crete the knowledge of the effects of climate change on agriculture and livestock farming and innovative actions to address them.
O15	Promotion of the planning of the agricultural policy of the Region of Crete, based on the levels of vulnerability in order the agricultural sector to adapt to the new climatic conditions.
O16	Changes in biological material and cultivation techniques.
Relevant policies and measures included	
P&M11	Recording the level of desertification of the Region's territories, draw up a soil map of an appropriate scale and updating it when necessary. Prediction and improvement/strengthen the system of recording the occurrence of zoonosis and plant pathogens in the Region of Crete, aiming at the early detection of new threats due to climate change, as well as the development of preparedness systems for addressing them.
P&M12	Publication of a Guide by the Region including areas of increased risk, the types of potential risks, the ways of relocation of the exploitation and the possibilities for relocation. Enhancing the protection of crops against extreme weather events (heat, frost, floods, windstorms, etc.) through modern agricultural insurance techniques (statistical methods, satellite imagery and agro-meteorological models). Providing economic incentives for the relocation of farms as well as livestock farms and productive animal farming units from high -risk areas in low -Development of an early warning system in the Region of Crete for extreme events (floods, high temperatures, fires, etc.). For the alerts, the system can use location- and population-based communication technologies, mobile phones, social media, etc. Temporary water storage projects (reservoirs, rehabilitation of wetlands, etc.), upstream of agricultural and livestock areas at risk of flooding (e.g., within Potentially High Flood Risk Zones (PHFRZ)) and the channelling of flood waters during the winter period. Upgrading and extension of Local Land Improvement Organizations (LLIO) in the Region of Crete. Incentives, replacement, and modernization of irrigation systems. Implementation of an appropriate irrigation water pricing policy (e.g., higher price on overconsumption). Creation of a grant mechanism to professional breeders for income losses due to extreme weather.
P&M13	Strengthen protection against parasites and diseases. Carry out a study on the mechanisms for the response of animals to extreme temperatures in terms of metabolism, physiology and in general their health (e.g., food consumption, liver function, immune response, mortality, infectious diseases, resistance to heat stress, etc.) as well as reproductive (estrous onset, conception rates, oocyte growth rate, embryo-fetal mortality, etc.) and capacity (milk production, milk chemical composition, growth rate, etc.) and measures to address these. Provide incentives to adapt housing and managing productive animals under the new environmental conditions shaped by climate change so that there is no negative effect on the well -being of aggravated animals. Providing incentives to improve outdoor conditions in livestock farming, indicative of planting tree plants, shelters and other ways in in the premises of plants and lairaging.
P&M14	Carry out a specialized study to investigate the effects of climate change on agriculture at the level of the region, focusing on crops of economic importance, Products of Designation of Origin (PDO) and Products of Geographical Indications (PGI) and proposing appropriate adaptation measures (e.g., shifting to higher altitudes, varietal change and crop restructuring/change). Carry out information actions, workshops, training seminars, by all appropriate means (e.g., media), to farmers and the relevant bodies and services of the Region of Crete, for the effects of climate change in the agricultural sector, the cultivation techniques suitable for the new climatic conditions of the Region, the resistant varieties to high temperatures, the sustainable methods of irrigation and the avoidance of salinization in low-altitude crops, issues of erosion and sustainable management of soil resources, etc.
P&M15	Integration of climate change adaptation actions into the Rural Development Program of the Region. Incentives to farmers to implement low input production systems (e.g., Organic Farming, Integrated Production Management Systems). Encourage farmers to manage land sustainably to reduce soil erosion.
P&M16	Pilot application of new (alternative) cultivation methods in selected species or geographical areas. For example, pilot restructuring of crops with drought-resistant species (e.g., carob tree). Study to identify the indigenous genetic material (varieties, etc.) suitable for cultivation in the Region of Crete under climate change conditions (e.g., material resistant to high temperatures, drought, etc.). Develop and strengthen existing genetic material banks for the storage of indigenous genetic material.
Main target addressed (#3)	**BIODIVERSITY**
Other relevant objectives or strategies addressed	

O17	Improvement of knowledge about the biodiversity of the Region of Crete and the impact of climate change on it and ecosystem services.
O18	Protection and enhancement of biodiversity to adapt to climate change and to help mitigate its impacts.
O19	Monitoring the mobility of invasive foreign species in the whole ecosystems of the Region of Crete.
O20	Information and awareness-raising actions.
Relevant policies and measures included	
P&M17	Empowerment of the ecosystem services. Facilitate access to environmental and climate information for public administration and local authorities to develop coherent and effective policies and interventions. Specialized studies to protect the most vulnerable habitats and biotopes and fauna and flora species of the Region of Crete from the effects of climate change, focusing on vulnerable endemic, endangered and protected species. Carrying out a specific study to protect the habitats of the Phoenix theophrastii palm tree. Climate change impact assessment study on landscapes of particular natural beauty and other areas of landscape protection and drawing up an action plan for their protection if necessary.
P&M18	Strengthen the ecological coherence of the Natura 2000 Network of the Region of Crete (planning and development of ecological routes between the areas of the Network, to facilitate the movement of vulnerable species to more suitable habitats for them, due to climate change). Land-use arrangements to halt the further decline and fragmentation of natural ecosystems and the loss of habitats of rare, threatened, or protected species of flora and fauna. Promoting biodiversity conservation measures (strengthening the vulnerabilities of biodiversity in their natural environment through the creation of in situ reserves and ex situ preservation thereof through the establishment of seed banks and genetic material) with priority to rare, endangered, and locally restricted species. Investigation for collaboration with existing seed banks and genetic material. Take action to maintain the ecological supply of river water bodies (WB) as well as to maintain ecological potential in highly modified water bodies (HMWB), with appropriate prioritization (e.g., development of a specific plan by HMWB and its monitoring program). Protection and enhancement of coastal ecosystems as a key measure of protection against sea level rise, salinization of groundwater and extreme weather events.
P&M19	Design a study to model the mobility of invasive foreign species and develop a monitoring system for their early detection. Conduct a species interaction study and develop a monitoring system for early diagnosis of diseases and epidemics. Develop a system for monitoring species and ecosystem functions of interest to record the response of biodiversity elements to climate change over time.
P&M20	Implementation of targeted actions at Regional level to inform and raise awareness about the adaptation of biodiversity to climate change. Indicative conferences are organized in schools, universities and municipalities.
Main target addressed (#4)	**TOURISM**
Other relevant objectives or strategies addressed	
O21	Adaptation of tourist facilities to climate change.
O22	Support for tourism adapt to climate change and to deal with extreme phenomena.
Relevant policies and measures included	
P&M21	Development of bioclimatic facilities in tourist areas e.g., use of “green” materials at the construction of new buildings and at renovations, vertical gardens etc. Optimization of thermal comfort during summer season, water saving and reuse, installation of RES and utilization of geothermal energy (heat pumps) to cover electricity demands etc. Energy upgrade of tourist areas buildings (thermal insulation, replacement of frames and lights, upgrade of air-conditioning system etc.)
P&M22	Specifying of the need to shift the tourism product over short -term horizon (period by 2040). Measures for the development of special and alternative forms of tourism (e.g., cultural, ecotourism) of the Region of Crete. Information, advertising, and tourism promotion actions planning. Briefing on the differences that arise in the tourism product due to climate change and promotion of the tourism sector after adapting it to the new conditions resulting from climate change. Administrative support, organization and awareness of climate change in tourist destinations. Use of communication technologies to spread information in cases of extreme phenomena and to disseminate visitors' safety guidelines. Creation of grant mechanism in case of disasters from extreme phenomena. Development of communal green areas in tourist areas to deal with the distress of visitors. Emphasis on specialized information on thermal comfort aimed at tourists / visitors, with a consequence of increasing the value of the

	tourism product. It is proposed to choose appropriate plants to avoid increased exposure of humans to allergens of natural origin. Actions to improve the visitor conditions of the archaeological sites and monuments of the Region of Crete during periods of very high temperatures.
Main target addressed (#5)	**CLIMATE DISASTER**
Other relevant objectives or strategies addressed	
O23	Actions to address the effects of climate change on river flooding.
O24	Integration of climate change impacts into flood risk management planning in the Region of Crete.
Relevant policies and measures included	
P&M23	Conservation and restoration of wetlands and riverbeds as natural flood protection. Construction of rainwater storage projects (or rehabilitation of wetlands where possible) in upstream areas where it is not possible to drain them safely (flood protection projects). It is proposed to give priority to nature - based solutions. Construction or extension of rainwater sewerage network, as a priority in the settlements of the Region of Crete located within Potentially High Flood Risk Zones (PHFRZ). Development of a telemetric network for the continuous measurement of rainfall, level, and supplies in the bodies of water of the Region which present the greatest risks. Implementation of innovative pilot actions on flood phenomena and exploitation of the results of existing pilot actions (e.g., flood protection projects).
P&M24	Provide funding for the implementation of projects and clean-ups in lowland and mountain water beds.
P&M25	Demarcation of areas with a high degree of soil erosion, on an appropriate scale, and proposal for specific measures by region. Implementation of anti-erosion projects. Construction of horticultural works. Construction of carrier material and water dam barriers to normalize rainwater drainage, reduce erosion and floods as well as control of increased river and stream stereo supply. Installation of branches, where appropriate.
P&M26	Study on the classification of forests according to fire risk and the definition of high-risk areas, in which it will be included an assessment of the vulnerability of the forest areas of the Region of Crete to climate change and proposals for their adaptation. Strengthening infrastructure to improve the fire protection of forests in the Region of Crete (e.g., fire-fighting zones, installation of additional water tanks, maintenance of existing forest roads and/or opening of new ones if required, etc.). Annual planning and implementation of appropriate interventions (beekeeping, controlled grazing, etc.) for the reduction/removal of flammable biomass. Installation of warning systems and development of fast and uninterrupted area evacuation software. Focus on areas with high traffic and restricted escape exits in the event of fire (e.g., gorges). Strengthen public information and awareness-raising activities on the protection of forests against fires.
P&M27	"Speed up the procedures for the restoration of the damaged burned areas to protect and stabilize the soil (e.g., sowing with suitable seed mixtures, after the outbreak of fire, at the beginning of the autumn season, combined with the laying of branches, to contain soil). Implementation of protection and restoration measures, based on studies carried out, prioritized according to the vulnerability ranking by geographical area in the short term (2040). In the context of the studies, resistant to new climatic conditions forest varieties should be selected and broader planting links should be used to limit competition in soil water. Public information and awareness actions to attract volunteers for the implementation of reforestation of fire-affected areas. Indicative actions are proposed by schools and associations, with day trips for this purpose. More emphasis should be placed on prevention, as a more economical solution, ensuring accessibility, by limiting fuel by means of cultivation interventions and controlled grazing. Modernization of forest fire-fighting equipment, installation of warning systems and rapid and uninterrupted evacuation software, training to avoid human casualties and restoration of natural ecosystems.
Actuation areas	National, Region of Crete
Additional relevant information	-

11.1.2. Annex 1.3. Deep analysis of document #3 of CS1

Table 59. Document #3 of CS1 Crete Island deeply analysed

Case Study	**CS1 – Island Sitia, Crete Island (GR)**		
#4	**National plan for increasing the number of nearly zero-energy buildings**		
Type of document	Plan	**Language(s)**	English
Scope	Sectoral	**Year of adoption**	2017
Web link	https://ec.europa.eu/energy/sites/ener/files/documents/greece_en_version_2017.pdf	**Target year**	-
Brief description	Improving the energy performance of buildings so that all new buildings are NZEBs by 1 January 2021 and all new buildings occupied by public authorities and the broader public sector are NZEBs by 1 January 2019. Major renovation of existing buildings to the level of NZEB.		
Sectors involved	Cities and urban planning		
Main target addressed	**Energy upgrade of buildings**		
Other relevant objectives or strategies addressed			
O1	Financial and other incentives: Revision of Law 4067/2012 - Article 25 'Incentives for constructing nearly zero-energy buildings'		
O2	Education / training: Technical guidelines (Manual) - NZEB training seminars		
O3	Institutional framework - regulations: Revision of Law 4122/2013, Article 21 'Building permits'		
O4	Demonstration actions: Pilot implementation of projects for improving the energy performance of public buildings		
Relevant policies and measures included			
P&M1	Buildings classified, according to its energy design, in KENAK's highest energy category A+ … ,or are operating with excellent environmental performance, an incentive is given by increasing the building ratio by 5-10%.		
P&M2	Drawing up and making available on the internet a technical manual on the implementation of NZEBs and their technical characteristics.		
P&M3	Training seminars on the practical implementation of NZEBs and their technical characteristics.		
P&M4	All buildings to meet the minimum energy performance requirements.		
P&M5	Public sector buildings to meet NZEB level within 20 years.		
Actuation areas	Greece and Crete in general		
Additional relevant information	-		

11.1.3. Annex 1.4. Deep analysis of document #4 of CS1

Table 60. Document #4 of CS1 Crete Island deeply analysed

Case Study	**CS1 – Island Sitia, Crete Island (GR)**		
#5	**Civil protection guidelines**		
Type of document	Guideline	**Language(s)**	Greek, English
Scope	Local	**Year of adoption**	2020
Web link	https://www.sitia.gr/information-services/politprostsitia	**Target year**	-
Brief description	It aims to inform citizens about the necessary self-protection measures against risks due to the occurrence of natural disasters, in accordance with the instructions of the General Secretariat of Civil Protection (www.civilprotection.gr).		
Sectors involved	Society		
Main target addressed	**Covering different climate hazards**		
Other relevant objectives or strategies addressed			
O1	Safety and protection of citizens against hazards related to climate change (Forest fires, Landslides, Floods, Winds, Storms, Snowfall, Frost, Heatwave)		
O2	Safety and protection of the agricultural environment.		
Relevant policies and measures included			
P&M1	Citizens' awareness.		
P&M2	Development of an early warning system and mechanisms of protection.		
P&M3	Actions of restoration (change of farmlands, collection of excessive rain water, cleaning up of abandoned areas from flammables).		
Actuation areas	Municipality of Sitia		
Additional relevant information	-		

11.2. Annex 2. Case Study 1 – Island (Sitia): PESTLE results for the local ecosystem drivers' analysis

The Sitia Case Study did realize the three PESTLE activities. The first one took place during the physical consortium meeting in Sitia, whose inputs can be seen in the following Figure 205. In that exercise, the PESTLE was done in a broader way, not only to consider the drivers (as positive things already in place) but also including challenges, which serve as basis for the goal definition in the last exercise from this PESTLE activity.

Figure 205. Sitia PESTLE analysis of local ecosystem drivers (activity during Sitia project meeting).

Then, a contrast exercise was performed by the Local Council of Stakeholders, from which the following outcomes were obtained (Table 61).

Table 61. Sitia PESTLE analysis of local ecosystem drivers – input from Local Council Stakeholders

Sitia CS POLITICAL local drivers
City planning that promotes the development of new infrastructure
There is a natural heritage protection plan only in natural areas
Protective regime for natural heritage areas
Land use plan that protects natural heritage areas
Sitia CS ECONOMIC local drivers
Active promotion of local green employment in the area
Local production is promoted with the existence of small units processing local products such as milk, honey, organic oil and wine. Also, small cooperatives that promote local dishes exist.
Promotion of the production of local products such as wine, oil, honey
Local stakeholders investing in renewable energy systems
Sitia CS SOCIAL local drivers
Local NGO that promotes the efficient use of resources by raising awareness among citizens
Local community organizations involved in initiatives to support vulnerable groups
Local public initiatives to decarbonize different means of transport
Sitia CS TECHNICAL local drivers

Municipal and cooperative Structure renovation to become carbon free
ICT (information and communication technologies) solutions deployed locally (e.g., 5G networks)
Implementation of Smart Cities systems by the Municipality of Sitia
Local bodies focusing on R&D (research and innovation) activities for climate change adaptation/mitigation
Sitia CS LEGAL local drivers
Major percentage of Sitia Municipality is under the UNESCO Geopark guidelines
Natura protected origins (East coast of Sitia-National law)
Sitia olive oil is under the regulations of protective origin products (prevention of chemical use, production of low agricultural waste-National law)
Protected areas with a specific legal framework within the territory
The existence of the Geopark of Sitia.
Legal framework for protection in natura areas, areas of archaeological interest, in coastal areas
Law that imposes the existence of an environmental study on specific activities and legislation on gender equality
Legislation requiring an environmental impact study for activities in the area
Law that mandates the carrying out of an environmental impact assessment per activity
Sitia CS ENVIRONMENTAL local drivers
Warmer winters due to climate change reducing heating needs (reduced energy consumption)
Due to climate change, the winters of recent years have become warmer, resulting in a reduction in energy consumption. But the increase in photovoltaics-A,C has seriously affected the flora and fauna of the area
Local bodies active in environmental protection, biodiversity conservation and sustainable development
Contribution to adaptation of climate change through a study on the development of infrastructure that enhances the resilience of the region against the effects of climate change

Furthermore, as part of the consultation to stakeholders, they provided suggestions for future planning, in a PESTLE analysis as well. It can be seen in following Table 62.

Table 62. Sitia Local Council Stakeholders' input on suggestions for future planning (in PESTLE structure)

Sitia CS POLITICAL local drivers
Develop Risk management guidelines for the public due to natural disasters that have occurred the last years in the district.
The support of urban plans should be done by scientists who have studied the design of new cities with what effect this has, for example saving energy, water and reducing waste, environmentally friendly buildings, and creating green spaces.
Reduction of municipal fees for citizens who develop green roofs
Plan for the use of rainwater that is otherwise lost in the sea
Management Plan for organic waste from the Municipality
Establishment of a scholarship from the municipality for graduate studies of the students of the Nutrition Department of the Mediterranean University on the positive effects on health from the consumption of locally produced olive oil
Infrastructure projects to prevent any consequences from extreme weather events due to climate change
Sitia CS ECONOMIC local drivers
Policies for the financial and social function of local economy factors after natural disasters
Development of protective measures so to prevent the consequences during a natural disaster
The processing of local products takes place in the production area resulting in energy savings, economic improvement of the community, and protection of local products. This assumes that farmers, beekeepers,

P.O.P and organic product producers will have financing support with favourable terms. This will be an incentive for the creation of small local production units and the avoidance of migration of young people will result in the production of green products and jobs. The training of the above categories of producers is necessary.
Financing for the purchase of shredders for the utilization of the residues from the pruning of the olive trees
Financial incentives for the maintenance and strengthening of dry stones, terraces in the fields to protect against soil erosion
Promotion of new agricultural crops, in order to avoid the consequences of monoculture
Development of "soft" tourism infrastructure, according to the principles of the Sitia Global Geopark
Sitia CS SOCIAL local drivers
For such a serious issue, the local government should take responsibility by informing the citizens about issues such as recycling, saving energy, water, reducing waste, etc. The ultimate goal should be the creation of eco-technical local production units that will produce green products and a small energy footprint on the environment.
The creation of an NGO would have a result and a serious social impact if it works in the context of volunteering and selflessness.
Creation of a body for educating citizens of all ages in environmental problems
Public incentives for recycling organic waste
Citizens' awareness of civil protection issues
Sitia CS TECHNICAL local drivers
Creation of application for public notification (weather, risks etc.)
Until now, the creation of 5G networks has resulted in the destruction of the local road network, with the result that it will have to be completely repaired in the coming years. Which means wasted energy, financial resources and currently no innovative improvement.
The 5G network will work positively in the future by promoting local eco-technical units and their products.
Utilization of existing studies for the management of waste from 2-phase olive mills
Collaborations with institutions for further research into the management of residues from olive and grape crops, which are the main ones in our Municipality
Creation of an information network for citizens and visitors, using applications, with information (general) but also a dynamic system for extreme weather phenomena (heat, etc.) as well as actions to be followed
Sitia CS LEGAL local drivers
The protected areas have been institutionalized and others can of course be included. Environmental studies are abundant and new ones are being conducted all the time. The result is, however, that the citizens have no idea what "reserved areas" mean, and neither do they know the value of studies for humans and nature. The result of the lack of cooperation between scientists and local bodies is that the term "protected areas" has taken the form of a punishment for their inhabitants. In this way, the environment-climate change-local economy pays for it. The solution is the cooperation of scientists with the local community with information, realistic proposals, and financial support of entrepreneurs in order to promote green employment.
Implementation of law on the burning of crop residues
Application of the law on uncontrolled grazing
Committees with legal power to evaluate and promote the resolution of citizens' legal issues (with the aim of reducing bureaucracy and legal procedures)
Sitia CS ENVIRONMENTAL local drivers
Continue Geoparks policies concerning biodiversity
Increase land plantation that can cope with dry weather and seasons with low rain percentage
In our area we have far exceeded the capacity of wind turbines in our mountains with a negative impact on the flora and fauna. Each company brings its own power lines down from the mountain for the city, with effects on the environment. The solution is photovoltaics on the roofs (of public buildings and houses) without batteries.

Therefore, electricity should not be a product of exploitation by private companies, but should be produced and consumed by citizens directly.
Implementation of existing regulations for crops, development of ecosystems according to the conditions of the local microclimate

All in all, a final exercise gathering inputs and collective feedback around the different drivers around each aspect was done, with a prior reflection on the case study vulnerable sectors, challenges and goals to overcome those challenges (Table 63), in order to set the basis for the final brainstorm on local drivers that can facilitate or enable the design and deployment of different policies at the case study.

Table 63. Sitia CS analysis of challenges and goals related to CS vulnerable sectors to serve as basis for the PESTLE analysis of local ecosystem drivers

SITIA VULNERABLE SECTORS
Agriculture, forestry and fishing
Water and waste
Biodiversity and natural heritage
Tourism, leisure and cultural heritage
CHALLENGES (mainly related with the vulnerable sectors)
Maintain agricultural productivity (presently use of pesticides and chemical fertilizers)
Environmental footprint of wind farms
Protection of NATURA 2000 sites and natural marine areas
Prevention of invasive alien species (plants & animals)
Monitoring technologies (agriculture, extreme events)
Municipality of Sitia data availability and distribution
Droughts / Dry - thermal conditions
Floods from climate extremes
Water scarcity
Wild fires
Coastal erosion
GOALS (to overcome the challenges)
Eco-friendly (bio) solutions instead of chemical pesticides
Better wind turbine design and placement: taller turbines, shorter blades, and placement away from bird habitats.
Protection of marine areas through targeted activities (awareness campaigns, volunteering groups)
Legal framework and monitoring campaigns for prevention of invasive alien species (plants & animals)
Development of Monitoring technologies (weather stations, water quality and consumption, flooding)
Existing data consistency and availability
Construction of water dams
Development of irrigation systems
Flood-protection constructions
Early warning systems, areas' risk characterization
Construction of breakwaters and artificial reefs
Study for the urban planning/ appropriate legal framework

The following Table 64 presents the final outcomes for such PESTLE analysis performed for the Sitia case study, considering also all previous inputs from the other activities as well as the basis of the vulnerable sectors, challenges and goals.

Table 64. PESTLE analysis of local drivers of Sitia Case Study (final activity)

POLITICAL SITIA CS local drivers
Promotion of Sitia's brand name for POD products e.g., olive oil
Land use plan that protects natural heritage areas
Civil protection plans for citizens/ community protection (wild fires, floods)
ECONOMIC SITIA CS local drivers
Economic support in the tourism sector in case of natural disaster in order to keep functioning
Integrated Territorial Investment Instrument for local funded actions for urban regeneration
Participation in LIFE+, Interreg programs
Funding for the energy upgrade of public buildings, green communal areas and touristic accommodation
Funding of farming, especially organic farming
Economic support to cover the cost of transportation for the collection of honey from migrated beehives
SOCIAL SITIA CS local drivers
Farmers cooperatives in which they discuss their problems and address them to local authorities.
Active volunteering groups for environmental preservation, disaster management, theatrical groups, female unions e.g., making local products.
Climate change awareness of citizens concerning its effects on biodiversity e.g., school communities, activities with groups of tourists, local communities etc.
TECHNICAL SITIA CS local drivers
Construction of water dam for irrigation
Replacing and upgrading of agricultural machinery
Wastewater treatment and reuse of rain water
PV systems 80MW - wind farms 84.6MW
LEGAL SITIA CS local drivers
Fines for farmers that do not comply with the regulations of fire department about burning waste
Imposition of fines of illegal and dangerous structures
Legislation regarding hunting and fishing periods
Environmental impact assessment
Gender equality plans
ENVIRONMENTAL SITIA CS local drivers
Preservation of Sitia's natural resources (Geopark of Sitia, NATURA 2000 areas, natural marine areas)
Expansion of Sitia's Geopark
More than 300 days/year of exploitable sunshine
Highest on-shore wind potential in Greece

11.3. Annex 3. Case Study 2 – Mountain Region (Trentino): Past experience and legal framework analysis

Table 65. Relevant documents identification of CS2 Trentino (those with first column in green are the ones selected for the deeper analysis)

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
1	**The Italian National Strategy for Adaptation to Climate Change |** *(IT: Strategia Nazionale di Adattamento ai Cambiamenti Climatici)*	Strategy	https://www.mite.gov.it/notizie/strategia-nazionale-di-adattamento-ai-cambiamenti-climatici-0	National	2016	• Cities and urban planning • Water and waste • Biodiversity and natural heritage	The main objective of the Strategy is to develop a national vision on common pathways to address climate change by counteracting and mitigating its impacts. The Strategy identifies actions and directions to minimise the risks from climate change, protect the health, well-being and assets of the population, preserve the natural heritage, maintain or improve the resilience and adaptive capacity of natural, social and economic systems, and take advantage of any opportunities that may arise from new climate conditions. To achieve this goal, the Strategy has defined five strategic axes of action aimed at: • improving current knowledge on climate change and its impacts; • describing spatial vulnerability, adaptation options for all relevant socio-economic systems and sectors, and possibly associated opportunities; • promoting stakeholder participation and awareness-raising in the development of sector adaptation strategies and plans through a broad process of communication and dialogue, also with a view to integrating adaptation into sector policies more effectively; • fostering awareness-raising and information on adaptation through widespread communication on the possible dangers, risks and opportunities of climate change; • specifying the tools to be used to identify the best options for adaptation actions and highlighting co-benefits.
2	**Report on the state of scientific knowledge on impacts, vulnerability and adaptation to climate change in Italy |** *(IT: Rapporto sullo stato delle conoscenze scientifiche su impatti,*	Other	https://www.mite.gov.it/notizie/strategia-nazionale-di-adattamento-ai-cambiamenti-climatici-1	National	2014		Pillar document at support of the National Strategy: it is a report that involved more than a hundred members of the Italian scientific community engaged in research on various aspects of climate change. The document assesses and reports various

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
	vulnerabilità ed adattamento ai cambiamenti climatici in Italia)						sectoral approaches while it contains a focus as well on the Alpine region.
3	**Elements for a National Strategy for adaptation to Climate Change |** *(IT: Elemementi per una Strategia Nazionale di adattamento ai Cambiamenti Climatici)*	Guideline	https://www.mite.gov.it/notizie/strategia-nazionale-di-adattamento-ai-cambiamenti-climatici-2	National	2019	• Energy • Cities and urban planning	Pillar document at support of the National Strategy, this document provides an overview of the impacts of climate change on multiple socio-economic sectors and natural systems and identifies a set of adaptation actions and directions to address these impacts. By implementing these actions and directions (or part of them), it will be possible to minimise the risks from climate change, maintain or improve the adaptive capacity of natural, social and economic systems, and take advantage of any opportunities that may arise under new climatic conditions.
4	**Analysis of European and national legislation relevant to impacts the vulnerability and adaptation to climate change - Technical and legal report of the National Climate Change Adaptation Strategy |** *(IT: Analisi della normativa comunitaria e nazionale rilevante per gli impatti la vulnerabilità e' l'adattamento ai cambiamenti climatica - Rapporto tecnico giuridico della Strategia Nazionale di Adattamento ai Cambiamenti Climatici)*	Policy	https://www.mite.gov.it/notizie/strategia-nazionale-di-adattamento-ai-cambiamenti-climatici-3	National	2019	• Energy • Cities and urban planning	Pillar document at support of the National Strategy, this Climate Report is an integral part of the National Strategy of Italian Adaptation: In the first part it examines legislation by the European Commission and the existing instruments for mainstreaming adaptation into the various EU sectoral policies. In addition, it provides an analysis of adaptation policies in EU countries and the set of rights, legal obligations and policy objectives of Member States with regard to impacts, vulnerability and adaptation to climate change, with an in-depth look at the state of reception of relevant legislation in Italy, for some sectors considered vulnerable to climate change and of major legal interest. The sectors considered in this study include: water, agriculture, environment and biodiversity, construction and infrastructure, energy, prevention of relevant industrial risks, liability and insurability, human health, soil and related uses, and transport.
5	**The Italian National plan for adaptation to climate change |** *(IT: Piano Nazionale di Adattamento ai cambiamenti climatici)*	Plan	https://www.mite.gov.it/sites/default/files/archivio/allegati/clima/pnacc.pdf	National	2018	• Water and waste • Biodiversity and natural heritage	This National Climate Change Adaptation Plan (NACCP) is aimed at implementing of the National Strategy by updating and better specifying its contents for operational purposes. The main objective of the Plan is to update the complex national knowledge framework on adaptation and to make it functional for the purposes of designing adaptation actions at different

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
						• Cities and urban planning • Energy	levels of government and in different sectors of intervention. In particular, the Plan identifies: • reference climate scenarios at the district/regional scale; • risk propensity; • sectoral impacts and vulnerabilities; • sectoral adaptation actions; • roles for the implementation of adaptation actions and measures as well as coordination tools between the different levels of territorial government; • estimated human and financial resources needed; • indicators of the effectiveness of adaptation actions; • ways of monitoring and evaluating the effects of adaptation actions.
6	**AGENDA 21: The climate pledges of Italian territories and cities |** *(IT: Gli impegni dei territori e delle citta' italiane per il clima)*	Other	http://www.a21italy.it/wp-content/uploads/2014/04/CA21L_Carta-e-Impegni-190410_per-stampa_2010.pdf	National	2010	• Cities and urban planning	A series of climate pledges form Italian Cities collected by the Agenda21 association.
7	**CLIMATE ACTION PLAN 2.0 |** *(IT: Action Plan 2.0 per il Clima)*	Plan	https://alpineclimate2050.org/wp-content/uploads/2021/04/ClimateActionPlan2.0_en_fullversion_FINAL.pdf	Regional	2020	• Tourism, cultural heritage • Transport • Biodiversity and natural heritage	It seeks synergies between different activities across sectors and borders, closing the gaps between actions and activities in order to address climate change. The implementation pathways that lie at the heart of this document contribute to the goal of reaching climate-neutral and climate-resilient Alps by 2050.
8	**The Italian National Integrated Plan for Energy and Climate |** *(IT: Piano*	Plan	https://www.mise.gov.it/images/stories/documenti	National	2019	• Energy • Water and waste	Plan, prepared for Italy in implementation of the European Regulation on the governance of the energy union and climate action. It is the tool where each state, with the implementation measures of the European Energy and Climate Package 2030,

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
	Nazionale Integrato per l'energia ed il clima)		/PNIEC_finale_17012020.pdf			• Cities and urban planning	establishes its own contributions to the European 2030 objectives on energy efficiency and renewable energy and defines the objectives in terms of energy security, single energy market and competitiveness.
9	**The Italian Long-Term Strategy for the reduction of greenhouse gas emissions**	*(IT: Strategia Italiana di Lungo Termine sulla Riduzione delle emissioni da gas a effetto serra)*	Strategy	https://ec.europa.eu/clima/sites/lts/lts_it_it.pdf	National	2021	• Energy • Transport	The Italian Long-Term Strategy identifies the possible pathways to achieve 'climate neutrality' by 2050, in which residual greenhouse gas emissions are offset by CO2 removals and by the possible use of geological storage and reuse of CO2.
10	**Trentino Provincial Sustainable Development Strategy (Agenda 2030)**	*(IT: Strategia PROvinciale per lo Svilippo Sostanibile - SproSS)*	Plan	https://agenda2030.provincia.tn.it/Documenti/Documento-preliminare-della-Strategia-provinciale-per-lo-Sviluppo-Sostenibile	Regional	2020	• Biodiversity and natural heritage • Tourism, cultural heritage • Agriculture, forestry and fishing • Energy	The provincial Strategy for Sustainable Development (SproSS) indicates the pathway towards a sustainable Province of Trento at 2030, with reference to the SDGs (Sustainable Development Goals) framework. It is formed by 5 priority action areas: for a Trentino that is smarter, greener, more connected, more social, closer to the citizens. Twenty provincial sustainability objectives are identified across the five priority areas.
11	**Trentino Climate 2021-2023**	*(IT: Trentino Clima 2021–2023)*	Other	http://www.climatrentino.it/binary/pat_climaticamente/notizie_clima/Trentino_Clima_2021_2023_finale_28.07.2021.1643181701.pdf	Regional	2021		The document represents the Work Programme on climate action of the Autonomous Province of Trento and addresses the activities towards the adoption of the Provincial Strategy for Mitigation and Adaptation to Climate Change. One of the activities consists in the publication of an updated Report on the State of the Trentino Climate.
12	**Environmental Energy Plan of the Trentino Province**	*(IT: Piano Energetico Ambientale Provinciale (PEAP)*	Plan	http://www.energia.provincia.tn.it/peap/	Regional	2021	• Energy	The document represents the Work Programme on energy of the Autonomous Province of Trento and addresses the activities towards the adoption of the Provincial Strategy for Mitigation to Climate Change. One of the activities consists in the publication of an updated Report on the Trentino energy production and consumption.
13	**Trentino Provincial Law no. 19/2013 on the assessment of environmental**		Law	https://www.provincia.tn.it/Documenti-e-	Regional	2013	• Transport	The Provincial regulation of environmental impact assessment. In its Art. 23 cites targets for the reduction of emissions and

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
	impact | *(IT: Legge Provinciale n.19/2013 sulla valutazione d'impatto ambientale)*		dati/Normative/L.P.-17-settembre-2013-n.-19#			• Cities and urban planning	energy consumption to 2030 and 2050, prefiguring energy self-sufficiency by 2050 and at the same time the concept of "Trentino Zero Emissions".
14	**Deliberation of the Provincial Council n.1836/2010 and further modifications with n.965/2018 |** *(IT: Verbale di deliberazione della Giunta Provinciale n.1836/2010 e sua successiva modifica con Delibera di Giunta n.965/2018)*	Regulation	http://www.climatrentino.it/binary/pat_climaticamente/provincia_trento_clima/Delibera_Giunta_5_agosto_2010_n_1836.1353062106.pdf	Regional	2010		Directives for the management of the Province's strategies and interventions to cope with climate change climate change - Establishment of the Provincial Coordination and Action Table on Climate Change and of the Trentino Climate Observatory and of the Climate and the Trentino Climate Observatory.
15	**SECAP Trento |** *IT: PAESC del Comune di Trento*	Plan	https://www.comune.trento.it/Aree-tematiche/Ambiente-e-territorio/Energia-sostenibile/Patto-dei-sindaci-per-il-clima-e-l-energia/Paesc#:~:text=Si%20tratta%20di%20uno%20strumento,mitigazione%20e%2012%20di%20adattamento	Local	2022	• Energy	It is a voluntary and ambitious plan, which needs the integration of multiple sectors and the involvement of key local actors to highlight all possible contributions to the achievement of European objectives. The PAESC currently being drafted is a fundamental document for defining the next strategies and objectives for territorial sustainability and combating climate change, as well as an important opportunity for reporting on existing activities and communication at all levels. It is a flexible tool, capable of evolving over time during the monitoring phase, which aims to establish synergies and collaborations in the territory that can contribute to the achievement of objectives. To this end, 26 mitigation and 12 adaptation actions have been identified.
16	**Climate Project 2008 - Predictions and consequences of climate change in Trentino |** *(IT: Progetto Clima 2008 - Previsioni e conseguenze dei cambiamenti climatici in Trentino)*	Project	http://www.climatrentino.it/binary/pat_climaticamente/provincia_trento_clima/libro_clima_2008.1366103860.pdf	Regional	2008	• Tourism, cultural heritage • Energy • Water and waste	The project aims to valorise, develop and manage periurban landscapes with their natural and cultural assets as part of the blue and green infrastructure network for a liveable and attractive Trento. To deliver it, it presents a climate assessment report.
17	Three-year plan 2022-2024 of Trentino Sviluppo S.p.A. on **Trentino's territorial promotion and tourism marketing activities**	Plan	https://www.trentinomarketing.org/media/w3adxyle/pm-2022-2024.pdf	Regional	2022	• Tourism, cultural heritage	The Marketing Plan defines the objectives of a system that wants to be distinctive, balanced, and long-lasting, in a perspective that is not only touristic, but involves the choices and destiny of the entire Trentino territory. The macro objectives envisaged relate to the pursuit of a Trentino open 12 months a year, always alive and welcoming, seeking greater balance in the relationship

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
							between residents and tourists, and of a Trentino that is always sustainable, with better occupancy of beds/months, a strong and competitive digital ecosystem and an efficient and coordinated tourism organization. The actions that will be put in place therefore imply lasting choices and investments over time, which will allow to leave to the next generations a better territory, and are aimed at having lively and hospitable localities in the four seasons, attentive to the quality of life of residents and able to offer moments of quality experience to guests, to limit the hyper-concentration and congestion of some places and in some specific periods of the year, to mitigate the risk of falling quality, guest satisfaction and citizen impatience.
18	**Dolomiti Paganella Future Lab**	Project	https://www.dolomitipaganellafuturelab.it/en/home-en/	Local	2020	• Tourism, cultural heritage • Society	Mission: Interpret the development of tourism on the Altopiano della Paganella as a positive force in order to establish a tenacious, cohesive, and resilient community, capable of managing the risks and opportunities that the future has in store with greater awareness and balance. It was conceived as a constantly evolving platform, unique in Italy, in order to define a balanced vision for the long term development of tourism in collaboration with the community, based on the day-to-day convenience and quality of life of residents and visitors. The work process is articulated into different stages of consultation, involving the local community and tourists, in order to build together and share a development model that enhances the value of the local territory over time.
19	**Val di Sole Back to the future**	Project	https://www.visitvaldisole.it/it/ritornoalfuturo	Local	2021	• Tourism, cultural heritage • Society	Val di Sole Back to the Future is a project developed by local DMO that aims to draw a shared path for the future, for the harmonious and sustainable development of territory and tourism.
20	**Trentino Provincial Law no. 20/2012 on energy |** *(IT: Legge Provinciale n. 20/2012 sull'energia)*	Law	https://www.consiglio.provincia.tn.it/leggi-e-archivi/codice-provinciale/Pages/legge.aspx?uid=23822	Regional	2012	• Energy	Provincial energy law and implementation of Article 13 of Directive 2009/28/EC of the European Parliament and of the Council of April 23, 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
21	**Trentino Provincial Law no. 4/2022 on renewable energy |** *(IT: Legge Provinciale n. 4/2022 sulle fonti rinnovabili)*	Law	https://www.consiglio.provincia.tn.it/leggi-e-archivi/codice-provinciale/Pages/legge.aspx?uid=37098	Regional	2022	• Energy	Measures for the promotion of the use of energy from renewable sources to achieve the targets for the development of renewable sources set out in Legislative Decree No. 199 of November 8, 2021 (Implementation of Directive (EU) 2018/2001 of the European Parliament and of the Council of December 11, 2018 on the promotion of the use of energy from renewable sources), and amendments to related provisions.
22	**Program agreement between the Autonomous Province of Trento**, 4 Trentino BIM (Mountain Water Basin) Consortia, Trentino Federation of Cooperatives and Trentino Association of Artisans (Deliberation of the Provincial Council n. 967/2022)	Other	http://www.energia.provincia.tn.it/ultimora/pagina337.html	Regional	2022	• Energy	Program agreement between the Autonomous Province of Trento, 4 Trentino BIM (Mountain Water Basin) Consortia, Trentino Federation of Cooperatives and Trentino Association of Artisans to support initiatives related to energy from renewable sources.
23	The "**Eco-catering Trentino**" Agreement between the Autonomous Province of Trento, the Municipality of Trento and associations of the Trentino restaurant industry The "**Eco-purchasing Trentino**" Agreement between the Autonomous Province of Trento, the Municipality of Trento and Trentino Organized Distribution	Other	http://www.appa.provincia.tn.it/sviluppo_sostenibile/accordi_volontari/	Regional	2012	• Energy • Water and waste • Tourism, cultural heritage	**Eco-catering Trentino**: the Autonomous Province of Trento signed on February 16, 2012, together with the Municipality of Trento, a Program Agreement with the trade associations of the Trentino restaurant sector. Catering establishments that obtain the "Eco-catering" label activate actions aimed at reducing their environmental impacts, through the reduction of waste and water and energy consumption, as well as customer awareness raising. **Eco-purchasing Trentino**: The Autonomous Province of Trento signed a Program Agreement with Trentino Organized Distribution on May 26, 2010. Stores that obtain the "Eco-purchasing" label activate actions aimed firstly at reducing waste, and secondly at better waste differentiation.
24	**Synthetic Hazard Maps |** *(IT: Carta di Sintesi della Pericolosità)*	Regulation	http://www.protezionecivile.tn.it/territorio/Cartografia/cartografiatematica/-Cartografiapericolo/pagina13.html	Regional	2022	• Cities and urban planning	The Synthetic Hazard Maps is one of the constituent elements of the Provincial Urban Plan and is responsible for identifying areas characterized by varying degrees of penalty for land use purposes due to the presence of hydrogeological, avalanche, seismic, and forest fire hazards described in the Hazard Maps.
25	**Water Quality Protection Plan (2022-2027) |** *(IT: Piano di tutela delle acque)*	Plan	http://www.appa.provincia.tn.it/pianificazione/Pian	Regional	2022	• Water and waste	Maintenance and/or improvement of biological and chemical quality of water bodies (rivers, lakes and ground waters)

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
			o_di_tutela/pagina36.html			• Agriculture, forestry and fishing • Biodiversity and natural heritage • Energy	
26	**Flood Risk Management Plan (2022-2027) |** *(IT: Piano di gestione del rischio alluvioni)*	Plan	https://bacinimontani.provincia.tn.it/Attivita/Pianificazione-territoriale/Direttiva-Alluvioni-2007-60-CE/Il-Piano-di-Gestione-del-Rischio-Alluvioni	Regional	2022	• Water and waste • Cities and urban planning • Biodiversity and natural heritage	The Flood Risk Management Plan considers all aspects of flood risk management, and in particular flood prevention, protection, and preparedness, including flood forecasting and warning systems, and takes into account the characteristics of the affected river basin or sub-basin.
27	**Research and Innovation Strategy for Smart Specialisation 2021-2027 (of the Autonomous Province of Trento) |** *(IT: Strategia per la specializzazione intelligente 2021-2027" (della Provincia autonoma di Trento)*	Strategy	https://www.provincia.tn.it/Argomenti/Focus/Strategia-di-Specializzazione-Intelligente-S3	Regional	2021	• Energy • ICT	Starting from an analysis of the European, national and the Provincial context, from the analysis of strengths and weaknesses of the system in Trentino and the challenges outlined (also based on the results of the stakeholder dialogue) the document "Smart Specialisation Strategy - S3 2021-2027" identifies: • priority trajectories and key enabling technologies (KETs) within the following areas: 1. Sustainability, Mountains and Energy Resources; 2. ICT and Digital Transformation; 3. Health, Nutrition and Lifestyles; 4. Smart Industry; • actions to improve the research and innovation system; • measures to strengthen interregional cooperation; • the governance, monitoring and evaluation of the strategy.
28	**GSTC certification (Global Sustainable Tourism Council)**	Other	https://www.gstcouncil.org/valsugana-tourism-board-joins-gstc/	Local	2019	• Tourism, cultural heritage	To certify the other three territories that are part, with Valsugana, of the Area Territorial Agency (ATA) Cities, Lakes and Highlands, to become the first sustainable tourism district. The other three

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
			https://www.visitvalsugana.it/it/area-operatori/2022/gstc-certificazione-di-sostenibilita/			• Society	territories are the Trento and Rovereto area and the Cimbri highlands. For the Valsugana territory, the goal is to move on to phase 2 of the certification, concerning accommodation facilities.
29	**European Charter for Sustainable Tourism (CETS) phase III**	Other	https://www.ufficiostampa.provincia.tn.it/Comunicati/Alle-APT-del-Parco-Naturale-Adamello-Brenta-la-Carta-europea-del-turismo-sostenibile-nelle-aree-protette	Local	2023	• Tourism, cultural heritage • Society	The certification of the APTs (Five Agencies for Tourism) represents the third and final stage of the path taken by the territory within the European Sustainable Tourism Charter, an instrument that is divided into three stages, each corresponding to specific subjects. The goal was for tourism to make a positive contribution to developing a "virtuous" economy that promotes and develops local potential and resources. Among the parameters to be met were those related, for example, to energy saving, proper waste disposal, but also to the enhancement of local products and the assistance provided to tourists so that they can have an experience under the banner of sustainability.

The sections below include the detailed analysis of the most relevant documents performed within the Trentino Case Study.

11.3.1. Annex 2.1. Deep analysis of document #5 of CS2

Table 66. Document #5 of CS2 Trentino deeply analysed

Case Study	**CS2 – Mountain region Tretino (IT)**		
#5	**The Italian National plan for adaptation to climate change |** *(IT: Piano Nazionale di Adattamento ai cambiamenti climatici)*		
Type of document	Plan	**Language(s)**	Italian
Scope	National	**Year of adoption**	2018 (published, not yet adopted)
Web link	https://www.mite.gov.it/sites/default/files/archivio/allegati/clima/pnacc.pdf	**Target year**	
Brief description	The National Climate Change Adaptation Plan was developed through a project funded by the Ministry of Environment and coordinated by CMCC. **It has been under review and has been awaiting Strategic Environmental Assessment approval since 2018**. Compared to the Strategy, the National Climate Change Adaptation Plan takes the form of a more operational tool directed to support from a cognitive point of view national institutions, regional and local institutions in defining their own sectoral and local adaptation pathways, including in relation to the critical issues that most connote them but it does not currently include a financial planning and possible allocation of funds. In this sense, the Plan constitutes a common base of data, information and analysis methodologies to be shared with all stakeholders with responsibilities in local and sectoral planning. The plan presents a methodology for the characterization of Macro-regions and homogeneous Climate Areas and a deep context analysis. **It collects 361 actions (21 selected as most relevant) and proposes a participatory approach with a National Forum and Observatory**. As regards to the focus of the Case Study Trentino the climate area identified is in the Macro-region 4 - Alpine Area. In the in-depth analysis priority has been given to measures and policies that concern tourism and energy, while water resources, healthy and mobility has been as well considered as closely related.		
Sectors involved	Water and waste	Biodiversity and natural heritage	Cities and urban planning
	Energy		
Main target addressed	This National Climate Change Adaptation Plan (NACCP) is aimed at implementing of the National Strategy by updating and better specifying its contents for operational purposes. The main objective of the Plan is to update the complex national knowledge framework on adaptation and to make it functional for the purposes of designing adaptation actions at different levels of government and in different sectors of intervention. In particular, the Plan identifies: • reference climate scenarios at the district/regional scale; • risk propensity; • sectoral impacts and vulnerabilities; • sectoral adaptation actions; • roles for the implementation of adaptation actions and measures as well as coordination tools between the different levels of territorial government; • estimated human and financial resources needed; • indicators of the effectiveness of adaptation actions; • ways of monitoring and evaluating the effects of adaptation actions.		
Other relevant objectives or strategies addressed			

O1	Characterization of Macro-regions and Homogeneous Climate Areas, context analysis and climatic vulnerability for Italy
O2	Identification and characterization of Adaptation Actions (361) and a selection of 21 most relevant on various scales
O3	Development of engagement/participatory tools
Main target addressed (#1)	**TOURISM**
Other relevant objectives or strategies addressed	
O4	Adapting tourism supply to the changing climatic conditions and to the unavailability of the traditional tourist attractions.
O5	Improving risk management for tour operators
O6	Temporary management of the tourist resource in view of a long-term adaptation
Relevant policies and measures included	
P&M1	TU002. Deseasonalization
P&M2	**TU003. Monitoring and warning systems in case of extreme events in urban environment**
P&M3	TU009. Preservation of local agricultural crops and products non-timber forestry through brands, labels or campaigns to image enhancement
P&M4	TU001. Diversification of tourism supply.
P&M5	TU010.Promoting insurance accounts for the management of climate risks
P&M6	TU005. Snow Farming for more sustainable snowmaking practices
P&M7	TU007. Use of existing artificial snowmaking systems only and their gradual decommissioning in favour of more sustainable snowmaking practices.
Main target addressed (#2)	**ENERGY**
Other relevant objectives or strategies addressed	
O7	Increase the use alternative energy sources
O8	Increase the resilience of the energy system and reduce the vulnerability of hydroelectric and thermoelectric production
O9	Promote and increase a better management of demand for energy for heating and cooling
O10	Reducing energy losses from transmission and distribution networks
Relevant policies and measures included	
P&M8	EN007. Installation of systems to monitor the progress of renewable sources
P&M9	EN020. Diversification of primary sources
P&M10	**EN021. Promotion of renewable energy sources and energy efficiency**
P&M11	EN023. Use of energy storage systems
P&M12	EN028. Development of distributed storage systems
P&M13	EN010. Replace fossil fuels used by conventional thermal power plants (from coal and fuel oil to gas natural gas)
P&M14	EN011. Replace open-cycle cooling systems with closed-cycle systems

P&M15	EN012. Use of air coolers, additional pumps or cooling towers cooling towers
P&M16	EN014. Increased availability of weather monitoring systems
P&M17	EN016. Use of modelling tools to support agreements and concerted actions
P&M18	EN027. Promote coordination with TSOs
P&M19	EN001. Retrofitting of Existing Buildings
P&M20	EN025. Use of service interruption contracts
P&M21	EN026. Promotion of the ongoing evolution from a centralised to a distributed system
P&M22	EN024. Network Integration and Development
P&M23	EN002. Climate proofing of new buildings
P&M24	EN015. Enhance control/monitoring of the variability of water supply
P&M25	EN017. Increase of storage reservoir volumes in the ordinary management
P&M26	EN018. Introduce economic incentives for the development of new storage capacity
P&M27	EN022. Realisation of interconnected basin networks on a regional or national scale
P&M28	EN003. Promotion of microgrid development
P&M29	EN006. Use of flexible AC transmission systems alternating current
P&M30	EN004. Promotion of demand-side management programmes ("demand side management")
P&M31	EN005. Underground development of part of the grid
Main target addressed (#3)	**WATER RESOURCES**
Other relevant objectives or strategies addressed	
O11	Increased awareness in communities
O12	Improve the effectiveness of monitoring
O13	Effectiveness in the use of the resource
O14	Improve the efficiency of the water infrastructure
O15	Use of a participatory approach in the use of river water
O16	Increase or change the runoff rate and volume
O17	Improve the effectiveness of regulation of the use of the resource.
O18	Update on the legislation and SEA practice
O19	Improvement of available data for the identification of risks.
Relevant policies and measures included	
P&M32	**RI008. Developing integrated programmes to improve the efficiency of irrigation, drinking water and industrial uses to optimise consumption**
P&M33	RI028. Awareness campaigns for property owners on the hydrological risks, risk mitigation measures, and reducing energy consumption.
P&M34	RI023. Refinement of decision support systems (services of irrigation advisory, early warning systems for drought risk, floods, landslides, floods, plant diseases and pathogen attacks)

P&M35	RI024. Restoration of a National Hydrographic Service
P&M36	RI025. Construction of water balance at the scale of the country
P&M37	RI026. Monitoring environmental indicators of transformation comparing them with values obtained for reference sites
P&M38	RI014. Review/adjustment of tariffs also considering environmental costs for better utilization of water resource use
P&M39	RI012. Establish a plan for financing and modernizing the water facilities and infrastructure
P&M40	RI022. Review of infrastructure contribution systems with respect to the specific hydrogeological characteristics
P&M41	RI013. Favouring participative forms of resource management, including 'River Contracts'.
P&M42	RI016. Systematic introduction of minimum vital runoff (MDV), i.e., ecological flow rate or ecological stream, in plans and practices management considering also the expected variations for conditions climate and runoff
P&M43	RI004. Redevelopment of watercourses in consideration of the maintenance of viable runoff and ecological quality in situations of water as of changes in future thermo-pluviometric regimes.
P&M44	RI021. Incentives to landowners to improve the capacity of retention
P&M45	RI011. Include index variables related to changing climate in the Strategic Environmental Assessment (SEA).
P&M46	RI027. High-resolution surveys to identify areas most vulnerable to flooding and drought.
Main target addressed (#4)	**INFRASTRUCTURES AND MOBILITY**
Other relevant objectives or strategies addressed	
O20	Improving knowledge and raise awareness, train and involve key players in the mobility sector on adaptation to climate change
O21	Integrating risks related to climate change in the planning and design towards resilience and adaptation
O22	Secure infrastructures
O23	Land securing
O24	Testing materials, structures, plants and technologies that are more resilient to rising temperatures and variability of precipitation
O25	Improving the effectiveness of monitoring, warning and intervention in the event of emergencies to transport services
Relevant policies and measures included	
P&M47	TR001. Raising awareness among the players of major infrastructural nodes
P&M48	TR014. Establish a cross-sectoral and multi-stakeholder table for the definition of common criteria, unified vulnerability analyses, options synergy options and intervention priorities
P&M49	TR002. Evaluate possible revisions of planning and/or design criteria
P&M50	TR006. Promote optimisation and integrated organisation in coordination with the Civil Protection
P&M51	TR003. Assess the synergy and co-benefits of sustainable mobility (mitigation and adaptation)
P&M52	TR009. Introduce green and ecosystem solutions within project prescriptions / guidelines
P&M53	TR013. Activate programmes to check the state of maintenance in the most sensitive infrastructures
P&M54	TR010. Revision and updating of the National Plan against hydrogeological instability

P&M55	TR011. Completing and updating the "Italia Sicura" Guidelines
P&M56	**TR004. Promote international research and exchange on climate-proof materials and methods**
P&M57	TR012. Experimental adaptation interventions and their monitoring
P&M58	TR005. Optimise techniques and procedures for the management of emergencies
P&M59	TR007. Establish monitoring and user information systems of the road
P&M60	TR008. Propose indicators for monitoring impacts and vulnerabilities (automatically collected) and implement systems integrated data analysis systems
P&M61	TR006. Foster the optimisation and integrated organisation in coordination with the Civil Protection
Main target addressed (#5)	**HEALTH**
Other relevant objectives or strategies addressed	
O26	Promote the capacity for climate risk governance for health and adaptation
O27	Promoting training and education on climate risks for health
O28	Improving knowledge and promote research on weather-induced risks and resilience
O29	Develop IT systems for monitoring of extreme events and health impacts
Relevant policies and measures included	
P&M62	SA009. Development of guidelines for updating procedures EIA, SEA, AIA
P&M63	SA003. Promotion of research on resilient technologies and materials
P&M64	SA019. Extension of insurance instruments to workers exposed to climatic risks
P&M65	SA008. Training of non-health professionals on climate- sensitive risks
P&M66	SA018. Environmental education programmes in schools
P&M67	SA002. Development of guidelines on the use of resilient technologies and resilient materials for local administrations
P&M68	SA001. Integrated information system on the impacts of extreme events on health
P&M69	SA017. Pilot project on interactions between meteo-climatic variables and food quality
Main target addressed (#6)	**Other objectives addressed**
Other relevant objectives or strategies addressed	
O30	Ecosystems And Biodiversity In Inland And Transitional Waters
O31	Geological, Hydrological And Hydraulic Instability
O32	Desertification, Land Degradation And Droughts
O33	Terrestrial Ecosystems
O34	Forests
O35	Aquaculture
O36	Urban Settlements (less pertinent to the CS)
O37	Infrastructure Critical Infrastructure - Cultural Heritage (less pertinent to the CS)

O38	Critical Infrastructure - Industries And Hazardous (less pertinent to the CS)
Relevant policies and measures included	
P&M70	**DI029. Planning public expenditure related to works for the prevention of hydraulic and geomorphological risks**
P&M71	**EA005. Guidelines for defining the ecological flow, functional to the maintenance and achievement of the objectives of quality of watercourses**
P&M72	**IP004. Identification of vulnerable areas (at risk of flooding, lightning or landslide) present on the national territory for existing infrastructures and existing hazardous activities**
P&M73	**IU007. Experimental adaptation interventions in peri-urban areas and in areas of supra-local competence**
P&M74	**PC011. Supporting techniques and practices related to rural landscapes traditional landscapes to improve the response to climate change**
Actuation areas	National with identification and homogenization of Climatic Areas
Additional relevant information	Each action has its specific proposed climate homogenization area of action in Italy and a proposed resource availability from diverse financial instruments. Its actuation areas are divided among sectors but many actions can be multidisciplinary. **For the selection of the most relevant actions**, an evaluation methodology was applied, which resulted in the attribution to each individual action of a value judgement (low, medium, medium-high and high) with respect to a number of criteria selected from the available literature (efficiency, effectiveness, second-order effects, performance in the presence of uncertainty, performance in the presence of available (efficiency, effectiveness, second-order effects, performance in the presence of uncertainty, policy implementation). Of the actions with a "high" value rating, the most relevant set of actions was selected the most technically and environmentally relevant set of actions. These are actions characterised by a specific environmental value, suitable for land management and increasing resilience at national level.

11.3.2. Annex 2.2. Deep analysis of document #7 of CS2

Table 67. Document #7 of CS2 Trentino deeply analysed

Case Study	**CS2 – Mountain region Tretino (IT)**		
#7	**CLIMATE ACTION PLAN 2.0 |** *(IT: Action Plan 2.0 per il Clima*		
Type of document	Plan	**Language(s)**	Italian, English, French, German, Slovinian
Scope	Regional	**Year of adoption**	2020
Web link	https://alpineclimate2050.org/wp-content/uploads/2021/04/ClimateActionPlan2.0_en_fullversion_FINAL.pdf	**Target year**	2050
Brief description	The Climate Action Plan 2.0 operationalises the objectives laid out in the Alpine Climate Target System 2050, a strategy focused on the added value of Alpine-wide cooperation on climate change mitigation and adaptation. It seeks out synergies between different activities across sectors and borders, closing the gaps between actions and activities in order to address climate change – one of the most pressing challenges in the Alps. The implementation pathways that lie at the heart of this document contribute to the goal of reaching climate-neutral and climate-resilient Alps by 2050. *The Case Study Trentino in fact is representative of the Alps and of the challenges that the Alps face with climate change since the Action Plan developed from the Alpine Convention could be a guideline of policies and measures particularly interesting for the main focuses on tourism and energy.*		
Sectors involved	Tourism, cultural heritage	Biodiversity and natural heritage	Transport

Main target addressed	It seeks synergies between different activities across sectors and borders, closing the gaps between actions and activities in order to address climate change. The implementation pathways that lie at the heart of this document contribute to the goal of reaching climate-neutral and climate-resilient Alps by 2050.
Main target addressed (#1)	**TRANSPORT**: a common modal shift and decarbonisation strategy as well as a coordinated approach for integrating alternative mobility solutions are identified as priority actions
Relevant policies and measures included	
P&M1	Implementation of a common policy framework for modal shift, based on steering measures as, for example, Toll Plus, which is a targeted and harmonized pricing system in the sensitive mountain areas or the Alpine Crossing Exchange as cap-and-trade approach to limit overall transport volumes
P&M2	Support of stakeholders in the take-up of innovative technologies, especially for rail and combined transport (freight) and public transport vehicles, to ensure that these elements of the transport network keep up in the innovation race.
P&M3	Development of recommendations for the gradual phase-out of internal combustion engine (ICE) vehicles on the Alpine transit corridors, ensuring that the best available vehicle fleet is used in the sensitive Alpine environment
P&M4	Implementation of an Alpine-wide information and integrated ticketing system for public transport
Implementation steps	

For freight transport:

- Lobbying for Toll Plus to raise awareness on the importance of the Eurovignette Directive as crucial European framework for road pricing and the need for keeping the ambitious approach of the ongoing revision process.
- Set up of an integrated Alpine-wide knowledge hub on innovative technologies for rail and combined transport to foster and support innovation in these segments.
- Kick-starting regional strategies for the phase-out of ICE vehicles based on a discussion on how to regulate their use in the different segments of road freight transport.
- Support for implementing a Toll Plus system through specific recommendations on how to implement Toll Plus at national level to set additional financial incentives for modal shift (after revision process of Eurovignette Directive is completed).
- Alpine Crossing Exchange: Further support for a cap-and-trade approach like the Alpine Crossing Exchange (ACE) based on a discussion on options on how to politically support the implementation of the ACE.

For passenger transport:

- Extension of youth Alpine Interrail tickets to continue and further support the Youth Alpine Interrail project for the next years.
- Completion and implementation of Alpine-wide information and ticketing system on public transport and alternative mobility solutions, integrated into local and regional mobility plans.
- New mobility tickets – further development of Alpine Interrail to increase the acceptance and use of public transport, especially regarding cross-border mobility as well as tourism mobility.
- Coordination of Alpine funding schemes for climate-neutral public transport fleets to develop the Alpine region into a model region for the take-up of climate-neutral public transport vehicles

Main target addressed (#2)	**ENERGY**: Promote the set-up of an Alpine-wide network of regional energy coordinators as well as pilot actions on climate-neutral lifestyles and business models
Other relevant objectives or strategies addressed	
O1	O2.1 close the "implementation gap" and to bring together the needs from different municipalities in order to develop joint solutions (bundling of activities)
O2	O2.2 support targeted awareness raising campaigns and tools on climate-neutral lifestyles and their specific needs in the Alps to trigger ambitious activities at private level (multiplier effects)
Relevant policies and measures included	

P&M5	To develop a training programme for regional energy coordinators as well as a platform for knowledge transfer to support the regular exchange within the network.
P&M6	To put a special focus shall on changing lifestyles and business models in the Alps. For this reason, a toolbox for Alpine households and SMEs will be developed to recognize their climate impact and to identify options for individual action. Actions as proposed in this toolbox will be tested and demonstrated in all Alpine countries in the frame of pilot actions.

Implementation steps

To support the set up of a network of regional energy coordinators:

- Strategic approach and set up of the regional coordinator network, building on existing structures but with the main objective to develop a common approach to ensure effective knowledge transfer.
- Pilot actions to support decentralized energy solutions in the Alps implemented through the new network (also including smart grid solutions).
- Alpine training programme for the members of the network of energy coordinators to enable a dedicated training, instruction and exchange of energy coordinators.
- Enlargement and diffusion phase to cover additional regions of the Alpine area or to reach out to regions in the broader perimeter.

To support climate-neutral lifestyles and business models in the Alps:

- Compilation of toolboxes on climate-neutral lifestyles and business models into an Alpine toolbox, e.g., including an online calculator for Alpine carbon footprints or tools for energy auditing schemes at regional level.
- Pilot projects on low carbon lifestyles and business models to test the acceptance and impacts of support measures and incentives

Main target addressed (#3)	**TOURISM:** Support the development of a common vision for climate-neutral and climate-resilient Alpine tourism

Other relevant objectives or strategies addressed

O3	O3.1 avoid unwanted distributional effects between tourism destinations that could arise if strategies and approaches on tourism development (intensive vs. sustainable/extensive offers) are not aligned;
O4	O3.2 ensure that the carrying capacity of specific tourism sites is not overstressed, taking into account potential impacts of climate change
O5	O3.3 optimize overall development of tourism activities in a qualitative way under the precondition of decarbonisation

Relevant policies and measures included

P&M7	Development of a common vision for sustainable tourism, including the coordination of strategic approaches towards the development of climate-neutral and climate-resilient tourism offers, the agreement on common climate goals/targets as well as monitoring and reporting issues
P&M8	Discussion on the alignment of financing streams and financial incentive measures to support the development of climate-neutral and climate-resilient tourism offers in the Alps
P&M9	Activities to support training and capacity building in the Alpine tourism sector, taking into account restrictions due to the COVID-19 pandemic

Implementation steps

- Identification of success factors and indicators for climate-friendly and climate-resilient Alpine tourism based on best practices and a targeted review of sustainable and innovative solutions. With a view to the COVID-19 crisis and an ongoing "boom" of outdoor recreations, activities related to all disciplines of nature-oriented tourism offers should be one focus for the investigation (e.g., bike-based tourism offers).
- Filling of data gaps on climate change impacts on tourism in the Alps and dissemination to stakeholders.
- Coordination of tourism strategies at Alpine-wide level to boost the transformation of tourism destinations.
- Alignment of financing streams for sustainable and climate-friendly tourism development, based on an assessment of status quo subsidies/financial support mechanisms.

- Set up of climate reporting framework for Alpine tourism destinations, which defines the reporting needs, and methods for tourism destinations as well as the further monitoring process.
- Training and capacity building for all relevant stakeholders in the tourism sector to enhance knowhow and skills for transforming the tourism sector and for getting support on implementing the activities as kick-started in this action plan.

Main target addressed (#4)	**NATURAL HAZARDS:** Develop an Alpine risk management plan to deal with cross-border risks in a coordinated approach
Relevant policies and measures included	
P&M10	Development of an Alpine-wide risk management plan on cross-border risks, including the definition of coordinated methods for risk mapping and monitoring, a strong coordination of approaches to deal with residual risks and a common toolbox on measures (including innovative technologies).
P&M11	Further actions to develop an Alpine-wide permafrost and erosion monitoring as well as Alpine-wide approaches on flood prevention and management

Implementation steps

- Synthesis of natural hazard management planning and consideration of cross-border risks to gather further information on natural hazard management approaches for cross-border risks in the Alpine countries.
- Mapping hazard hot-spots for critical infrastructures and settlements with a special focus on hot-spots related to transport, energy and communication infrastructures but also health infrastructures and settlements.
- Common framework for risk-management of cross-border risks including a common understanding of the risk management cycle, common methods and standards for risk mapping and monitoring as well as recommendations and tools on risk preventions measures for cross-border risks.
- Development of a common permafrost monitoring based on a comprehensive Alpine-wide stocktaking and mapping of existing permafrost monitoring activities, stations and networks, taking into account the potential of remote sensing data and services.

Main target addressed (#5)	**WATER**: Support the set up of an Alpine-wide framework for climate proofing of water management systems as well as to develop a coordinated approach to deal with new challenges related to drought events
Relevant policies and measures included	
P&M12	Set up of an Alpine-wide framework to promote transboundary planning tools and participation processes as well as enable intersectoral cooperation (administrative level) and integration of the key stakeholder groups within a river basin beyond the national processes of river basin management plans, to strengthen the implementation of the EU Water Framework Directive as well as other relevant guidelines.
P&M13	Development of a common approach to deal with drought management throughout the Alps, taking into account water availability in the whole river basin. Such an approach needs to consider possible needs and pressures coming from other drought hot-spots downstream, also beyond the Alpine Convention perimeter, and to ensure that drought management measures are in line with the preservation of ecosystems and their services.

Implementation steps

To support a common framework for climate proofing of water management systems:

- Identification of hot-spots and mapping of ongoing coordination activities as basis for identifying model river basins at Alpine-level where increased cooperation between neighbouring countries would support the avoidance of conflicts between different water use interests.
- Promote model projects for climate proof and transboundary integrated water management to increase regional and transboundary cooperation.
- Broadening governance structures for conflict management based on effective and comprehensive alliances for managing water-related conflicts for the identified model river basins.

To develop a common approach towards drought management:

- Interactive map on drought hot-spots under different climate scenarios, based on a common method on thresholds, scenarios definition and classification system.
- Early warning and emergency plans on droughts to identify drought situations at an early stage and to trigger relevant measures.

- Concept for infrastructural measures to reduce drinking water consumption for non-drinking purposes, such as water toilets, irrigation and artificial snowmaking.

Main target addressed (#6)	**SPATIAL PLANNING**: Build an Alpine-wide concept "Spatial planning for climate action" to ensure a climate proof framework for spatial planning
Other relevant objectives or strategies addressed	
O6	O6.1 ensure that spatial planning as interface to other sectoral activities is considered in a common approach to integrate new challenges related to mitigation and adaptation policies;
O7	O6.2 ensure that spatial planning concepts boost other activities included in the Action Plan
Relevant policies and measures included	
P&M14	Gathering an overview of climate change impacts on or by land use, as the starting point for an Alpine-wide concept, highlighting focus topics for further action and key challenges
P&M45	Development of a common approach on land protection as one crucial driver for mitigation actions, building on harmonized data on land-take and a survey on land-protection targets in the Alpine countries as well as an exchange on good practices for growth and shrinking strategies
P&M16	Guidance on "Spatial planning for climate action" for municipalities of the perimeter of the Alpine Convention to bring together recommendations and insights on how to integrate mitigation and adaptation concerns into local spatial planning practices.

Implementation steps

- Common data pool on climate change impacts on or by land use highlighting impacts with cross-border relevance, e.g., the impacts on cross-border infrastructure, energy production and settlement development, using different climate scenarios.
- Good practice exchange for growth and shrinking strategies, including a survey on land protection-targets and challenges as implemented in Alpine countries and challenges related to their implementation.
- Awareness raising on the link between climate action and spatial planning through highlighting the mitigation benefits of containing sprawl.
- Guidance for municipalities for sustainable (e.g., climate proof) land-use and adaptation based on existing approaches and tools.

Main target addressed (#7)	**SOIL**: Develop an Alpine-wide framework for preservation of carbon-rich soils as well as reducing land-take and land-sealing (soil quantity)
Other relevant objectives or strategies addressed	
O8	O7.1 to ensure that carbon-rich soils are identified with a comparable approach at an Alpine-wide level and that further preservation activities target these soils;
O9	O7.2 to develop a common approach on reduced land-take, being integrated in the spatial planning concept as proposed in the Climate Action Plan as well as other sectoral activities.
Relevant policies and measures included	
P&M17	A soil survey and mapping, based on a common soil classification system, to provide insights on carbon-rich soil types and on the need for preservation measures. Especially, additional knowledge on soil types in high elevation areas is necessary
P&M18	Development of a common framework for preservation of carbon in soil, including recommendations for measures to preserve and increase carbon stock in soils and for the protection and/or rehabilitation of peatlands, moorlands and wetlands as well as an Alpine wide awareness raising campaign.
P&M19	A common definition for land-take, land-sealing and brownfield redevelopment and a common understanding for monitoring of developments in these fields to establish a framework for redevelopment of brownfields and reducing land-take and thus for preserving soil quantity.
P&M20	Set up a framework of incentive system-regulations and best-practise examples to motivate efforts for avoiding land-take and increased redevelopment of brownfields, building on recommendations developed by Alpine-wide

	soil protection and spatial planning networks. Insights from using these incentive systems will be integrated in guidelines for land-use planning at municipal level.
Implementation steps	
To support preservation and sequestration of carbon in soil: • Alpine-wide soil classification system and mapping, based on a common agreement on soil types (especially C-rich soil types like peatlands, moorlands and wetlands). This classification system would be the basis for fostering exchanges between further initiatives and stakeholders aiming at soil protection. • Communication campaign on soil protection to raise awareness on the relevance of carbon in soil. • Recommendations on prevention, protection and compensation measures with the focus: to maintain and restore carbon stock in soil and reactivate peatlands and support of pilot projects to implement these recommendations. **To set up a common framework for avoiding land-take and sealing as well as increased redevelopment of brownfields:** • Operation with a common definition for land-take, land-sealing and brownfield redevelopment, based on a compilation of existing data on soil quality and soil functions and compatible with existing land use statistics in Alpine countries, leading to a common approach for monitoring future land-take and brownfield redevelopment. • Coaching of spatial planners and decision makers through fostering communication about the importance of spatial planning as tool for soil protection, and the necessity to consider data on soil quality and functions in spatial planning. • Alpine-wide recommendations for an economic incentive system and related demonstration activities. • Guidelines for land use plans at the municipal level and communication including strategic action in spatial planning as well as small-scale measures for soil sealing reduction as well as a communication campaign to spread these guidelines.	
Main target addressed (#8)	**MOUNTAIN AGRICULTURE:** Potential of mountain agriculture for testing and demonstrating climate-neutral production and distribution techniques and supports further measures to increase their uptake
Other relevant objectives or strategies addressed	
O10	O8.1 to ensure synergies with other sectoral efforts, which are coordinated at Alpine-wide level, especially soil and water protection as well as tourism
O11	O8.2 to ensure that efforts extend beyond regional and national borders as value-chains of Alpine food products often have a cross-border character
Relevant policies and measures included	
P&M21	Promotion of local Alpine products and increase of locally retained added value from marketing and distribution of climate-friendly products at local and regional level. All promotional activities shall be based on a previous evaluation of CO2-impacts of such a higher use of Alpine products and local value chains
P&M22	The set up of a scheme for low-CO2 or CO2-neutral agriculture in the Alps, based on a significant increase of the share of Alpine agriculture adopting climate-friendly and organic farming methods, which shall also significantly reduce the use of chemicals in farming.
Implementation steps	
To further strengthen the development of local value-chains for Alpine food products: • Indicators for climate-friendly and sustainable Alpine farms to be applied at the farm level (organisation) or at the farm product level (good). • Set up of an Alpine regional strategy for climate-friendly agriculture, including support and marketing strategies, marketing initiatives, green public procurement, incentivisation of direct marketing of Alpine farming products etc. • Set up an "EU Day for the Alpine or mountain products" (EUDAMP) with major events and supported by an EU-wide campaign. **To incentivize the uptake of climate-friendly farming techniques:** • Stocktaking on organic agriculture in the Alps and scenario, including information on management techniques and their specific GHG reduction potential as well as other environmental impacts. • Identification of innovative management techniques and their demonstration in the frame of pilot activities to test innovative management techniques that support the transition to a higher share of organic farming in the Alps at reasonable costs.	

- Policies to support a transition to Alpine organic farming, including an inventory of existing such policy initiatives in the Alpine regions and, on this basis, the development of specific recommendations for further policy actions to increase the share of organic farming.

Main target addressed (#9)	**MOUNTAIN FORESTS:** Supports a coordination of management techniques to make full use of mountain forests' potential and to support their conversion
Other relevant objectives or strategies addressed	
O12	O9.1 to ensure that state-of-the-art nature-based approaches are applied throughout the Alps to make full use of the ecosystem services from mountain forests
O13	O9.2 to ensure that mountain forests throughout the Alps are managed within a common framework, supporting other sectoral activities
Relevant policies and measures included	
P&M23	Development and application of "Alpine guidelines" for conversion of forests to more resilient and close-to-nature forest ecosystems, based on a broad stakeholder approach and under consideration of other sectoral activities within this Climate Action Plan.
P&M24	Further development of knowledge exchange on mountain forests as protection from natural hazards.
P&M25	Strengthening of the regional value added chain of wood in the context of circular economy and bio-economy
Implementation steps	

- Forest development scenarios under climate change in the Alps, including information on forest types (species) as well as ages.
- Guidelines for Alpine forest conversion based on insights of this forest scenario study, including concrete examples and guidelines on management techniques.
- Testing financial incentive schemes in pilot areas to provide financial support for resilient forestry throughout the Alps.
- Implementing regional value added chains of wood in the Alpine regions.

Main target addressed (#10)	**ECOSYSTEMS & BIODIVERSITY:** Development of a common management approach to ensure these functions under climate change
Other relevant objectives or strategies addressed	
O14	O10.1 to ensure that the Alpine territory remains permeable and liveable for all species by protecting and managing vulnerable and Alpine-specific landscapes and ecosystems;
O15	O10.2 to enhance transboundary cooperation on ecological connectivity, also between the Alps and their periphery as well as with other mountainous regions
Relevant policies and measures included	
P&M26	Development of recommendations for planning, protection, restoration and management of vulnerable and Alpine-specific landscapes, applying ecosystem-based approaches. These recommendations should build on a comprehensive stocktaking of vulnerable landscapes, Alpine-specific landscapes and ecosystems as well as wilderness areas and distribution and occurrence of invasive alien species to get a common understanding on need for action.
P&M27	Set up of a common concept for the handling of invasive species (neobiota).
P&M28	Development of a "climate change management plan" for protected areas and other conservation areas, containing both mitigation and adaptation aspects and ensuring a smart embedding in spatial planning instruments.
P&M29	Support exchange between stakeholders (protected areas and other conservation areas) and regular meetings.
Implementation steps	
To protect and manage vulnerable and Alpine-specific landscapes and ecosystems:	

- Stocktaking on landscapes, ecosystems and nature reserves in the Alps, as well as the ecosystem services they provide, as basis for all further activities.
- Data collection of invasive alien species in the Alpine area, including a mapping of neobiota distribution.
- Management and preservation recommendations for Alpine-specific landscapes to improve their planning, management, restoration and preservation.
- Monitoring of the implementation of existing regulations in the Alpine area, including the implementation of EU Regulation II43 / 2014 on the prevention and management of the introduction and spread of invasive alien species, the UNESCO Man and Biosphere Programme, Bern Convention on the Conservation of European Wildlife and Natural Habitats, the EU Habitat and Birds Directive as well as strategies and reports under the Convention on Biological Diversity.

To further develop ecological connectivity in the Alps with a focus on climate impacts:

- Definition and stocktaking in the Alpine area (focus on transboundary areas) including protected areas and other conservation areas as well as definitions of those areas.
- Establishment of a stakeholder network and regular meetings based on existing initiatives with the objective of facilitating the exchange and cooperation of managers in the context of transboundary cooperation.
- Strengthening of mitigation and adaptation aspects in management plans, including through the implementation of nature-based solutions, and designation of new ones protected areas, for example UNESCO biosphere reserves, to cover species, habitats and ecological processes that would no longer be included due to the shifts caused by climate change.

Main target addressed (#11)	**Cross-cutting**
Relevant policies and measures included	
P&M30	A strong CO2-price, established either in the frame of national legislation or in form of an extended EU Emissions Trading System, provides a market-based approach to improve the competitiveness of energy efficient and climate-neutral technologies. The Alpine countries should work towards a common approach for a strong CO2-price signal.
P&M31	The approach of a Green Budget Reform, which shifts taxes from labour to environmental taxation, sets further financial incentives for the take-up of ambitious climate action. Different experiences with a Green Budget Reform have been gained throughout the Alpine region, and the Alpine Conference supports a further coordination and exchange on these approaches –providing synergies with its Green Economy Action Plan.
P&M32	Green Financing should be the key rationale for the next programming period of relevant EU-funding and investment programmes. The Alpine Conference thus fully supports the approach of the EU Green Deal in general and welcomes the proposed new orientation of the Alpine Space Programme 2021-2027 with a focus on climate action and other environmental issues.
P&M33	Measuring Alpine well-being could be done by building up a sample of indicators beyond GDP.
P&M34	Recovery Programmes to tackle economic effects of the COVID-19 crisis should also follow this principle and should take a “Green Recovery approach”. It needs to be ensured that National Resilience and Recovery Plans maximise their share of climate-related spending and use this opportunity to accelerate it.
Actuation areas	-
Additional relevant information	This plan extends from the National Scale and involves the Alpine Convention and its Member States. The Plan focuses on the on the medium-term horizon (next five to ten years) and proposes detailed implementation pathways, which are about to be launched or can be launched within the next one to two years to be further developed until 2030. Through the involvement of representatives of all Alpine States, the underlying implementation pathways and the Climate Action Plan 2.0 take into account the existing regional, national and transnational programmes and measures that are being implemented in various Alpine countries. Since all measures have been described with implementation steps and moreover detailed technical tables with more information on the possible implementation plan are available.

11.3.3. Annex 2.3. Deep analysis of document #8 of CS2

Table 68. Document #8 of CS2 Trentino deeply analysed

Case Study	**CS2 – Mountain region Tretino (IT)**		
#8	**The Italian National Integrated Plan for Energy and Climate |** *(IT: Piano Nazionale Integrato per l'energia ed il clima)*		
Type of document	Plan	**Language(s)**	Italian, English
Scope	National	**Year of adoption**	2019
Web link	https://www.mise.gov.it/images/stories/documenti/PNIEC_finale_17012020.pdf	**Target year**	2030
Brief description	The PNIEC (Integrated Plan for Energy and the Climate) is the plan, prepared for Italy's in implementation of the European Regulation on the governance of the energy union and climate action. It is the tool where each state, with the implementation measures of the European Energy and Climate Package 2030, establishes its own contributions to the European 2030 objectives on energy efficiency and renewable energy and defines the objectives in terms of energy security, single energy market and competitiveness.		
Sectors involved	Energy	Water and waste	Cities and urban planning
Main target addressed	Plan, prepared for Italy in implementation of the European Regulation on the governance of the energy union and climate action. It is the tool where each state, with the implementation measures of the European Energy and Climate Package 2030, establishes its own contributions to the European 2030 objectives on energy efficiency and renewable energy and defines the objectives in terms of energy security, single energy market and competitiveness.		
Other relevant objectives or strategies addressed			
O1	Accelerate the decarbonisation pathway, considering 2030 as an intermediate step intermediate step towards a deep decarbonisation of the energy sector by 2050 and integrating the environment variable into other public policies.		
O2	Putting citizens and businesses (especially small and medium-sized ones) at the centre, so that are protagonists and beneficiaries of the energy transformation and not just subjects financiers of active policies; this means promoting self-consumption and renewable energy communities, but also maximum regulation and transparency of the sales segment, so that the consumer can benefit from a competitive market.		
O3	Encouraging the evolution of the energy system, particularly in the electricity sector, from a centralised set-up to a distributed one based mainly on renewable sources.		
O4	Continue to ensure adequate supplies of conventional sources, pursuing security and continuity of supply, being aware of the progressive decline in requirements of these conventional sources, both for the growth of renewables and for energy efficiency energy efficiency.		
O5	Promote energy efficiency in all sectors, as a tool for protecting the environment, improving energy security and reducing energy expenditure for households and businesses.		
O6	Promote the electrification of consumption, particularly in the civil and transport sectors, as a means of also improving air and environmental quality.		
O7	Accompany the evolution of the energy system with research and innovation activities that consistent with European guidelines and with the needs of deep decarbonisation deep decarbonisation, develop solutions that promote sustainability, security, continuity and cost-effectiveness of supplies increasingly based on renewable energy in all sectors of use and promote the reorientation of the production system towards processes and products with a low carbon footprint that also find opportunities in the demand induced by other support measures.		
O8	Adopt, also taking into account the conclusions of the Strategic Environmental Assessment process of Strategic Environmental Assessment and related environmental monitoring, measures and arrangements that reduce the		

	potential negative impacts of energy transformation on other equally relevant objectives, such as the quality of air and water bodies, the limitation of soil consumption and landscape protection.
O9	Adopt measures that improve the ability of renewables themselves to contribute to the security and, at the same time, foster market structures, infrastructures and rules that, in turn, contribute to the integration of renewables.
O10	Continue the process of integrating the national energy system into that of the European Union.
Relevant policies and measures included	
P&M1	Careful governance of the plan that enables its coordinated implementation and ensures unity of action, particularly in the timing and processes of authorisation and realisation of physical infrastructure, in the coordination of research and innovation activities and more generally, in monitoring the effects of the plan in terms of reorientation of the production system, as well as costs and benefits.
P&M2	Evaluation of the actions necessary for an effective simplification of procedures for the implementation of interventions within the planned timeframe. This, together with the stability of the legal and regulatory framework, consistent with the need to update periodic updating of the paths outlined, resulting from technological evolution and the monitoring of costs and benefits of individual measures.
P&M3	Updating of the tasks - and, if necessary, the reform - of the various public bodies working on energy and environmental issues, so that their respective roles and activities are coordinated and functional to the objectives of the plan and, more generally, to the goals of deep decarbonisation for 2050.
P&M4	The promotion of research activities, also involving grid operators, on ways to develop the integration of systems (electricity, gas, water), exploring, for example, the possibility of using existing infrastructure for renewable energy storage, also in the long term, with cost-effective solutions from an economic and environmental benefits.
P&M5	Integration of new technologies into the energy system, starting with the information technologies, to facilitate distributed generation, security, resilience energy efficiency, as well as the active participation of consumers in energy markets.
P&M6	Willingness to consider additional instruments, if needed, such as the revision of energy taxation, diversified on the basis of climate-altering and polluting emissions and in any case in line with EU guidelines on the subject, with attention to the weak segments of the population and production sectors that do not yet have alternative alternatives to traditional fuels and fuels.
P&M7	Possibility of using the flexibility mechanisms of European sectoral legislation.
Main target addressed	**Decarbonisation**: between 2021 – 2030, achieve the target of reducing greenhouse gas emissions by -33% compared to 2005. Realise the national contribution to the achievement of the binding EU 2030 renewable energy target and trajectories.
Main target addressed (#1)	**CIRCULAR ECONOMY AND WASTE**
Other relevant objectives or strategies addressed	
O11	Improve material efficiency as the main driver of improvement of technical performance.
Relevant policies and measures included	
P&M8	Extension of product life
P&M9	Reuse-repair
P&M10	Choice of less carbon-intensive materials at the production stage
P&M11	Reduction of materials and choice of lighter materials
P&M12	Sharing of goods
P&M13	Recycling and end-of-waste status
P&M14	Industrial symbiosis

Other relevant objectives or strategies addressed	
O12	Increase of separate collection and the subsequent recycling of separately collected fractions
Relevant policies and measures included	
P&M15	In order to reduce waste production and contain GHGs reductions, a contribution of 40 million grant for the years 2020-2021 for the experimentation of 'green corners' for the sale of corners' for the sale of products in bulk or on tap in city shops has been planned as well as to promote the opening of new entirely 'green' shops.
P&M16	In order to curb the production of plastic waste, it is planned to set up the experimental 'plastic-eating' programme with a budget of EUR 27 million for the period 2019-2024 to be provided to municipalities and large-scale retail businesses that want to equip themselves with so-called 'plastic-eating' machines. So-called 'plastic-eating' machines, which collect plastic bottles and, in return, return a bonus to the citizen.
P&M17	In order to initiate information, training and awareness-raising campaigns on environmental issues in schools, a specific fund called 'I am Environment' is established with EUR 6 million for the period 2020-2022.
Main target addressed (#2)	**AGRICULTURE AND FORESTRY**
Other relevant objectives or strategies addressed	
O13	Phasing out coal-fired power generation by 2025
Relevant policies and measures included	
P&M18	New gas-fired capacity of about 3 GW, of which about 50% is substantially related to the phase out, and new storage systems for 3 GW in the central areas, southern areas and Sicily.
Other relevant objectives or strategies addressed	
O14	Tacking greenhouse gases, consisting mainly of methane, ammonia and nitrous oxide with different sectorial plans
Relevant policies and measures included	
P&M19	National indicative code of good agricultural practice for the control of ammonia: which shall include: a) nitrogen management, taking into account the entire nitrogen cycle; b) livestock feeding strategies; c) emission-reducing manure storage and spreading techniques; d) emissions-reducing housing systems; e) possibilities to limit ammonia emissions from the use of mineral fertilisers.
P&M20	Common Agricultural Policy (CAP) 2021-2027 with the measures: a)the strengthening of cross-compliance that will see direct payments subject to stricter environmental requirements; b) the obligation for Member States to introduce ecological schemes that have a positive impact on climate and the environment, but whose use is optional for individual farms, in the first pillar (direct income support for farmers and market measures); c) payments for environmental, climate and other management commitments, in the second pillar (rural development).
P&M21	Promotion of CO2 sequestration measures in agricultural soils and forestry systems also considering potential payment measures for ecosystem services for forestry and related to agricultural soils and to both herbaceous (arable, etc.) and tree cropping systems.
P&M22	Preparation of the Annual Report on Italian Forests (RAF) by strengthening of the precise knowledge of Italian forests in all their aspects: naturalistic, productive, economic, etc. In addition, it is planned to collect information from all the stakeholders involved, including the regions, territorial authorities, Istat, as well as the economic and scientific sectors.
P&M23	Adoption of the Unified Law on Forests and Forestry (TUFF) which will recognise Sustainable Forest Management as an instrument aimed at ensure an increase in carbon absorption, including in the production of quality wood products over a ten-year period, and a gradual change in the rates of utilisation rates recorded to date, with a shift from the current 30-33% per year to a possible 40-45% utilisation.
P&M24	The Decree-Law No. 81/2018 implementing Directive (EU) No. 2016/2284 foresees a) the development, adoption and implementation of the national air pollution control programme in coordination with policies adopted on

	climate change; b) the production of national emission inventories and projections; c) the monitoring of emissions not subject to reduction requirements; d) the monitoring of impacts on ecosystems.
P&M25	Implementation of Regulation (EU) No 517/20: in order to reduce the emissions of fluorinated greenhouse gases occurring during the installation, maintenance, repair and decommissioning of equipment that contain such gases which provides for the adaptation of the certification system for natural persons and companies carrying out such transactions, and the establishment of a 'database' for the collection and storage of information on the sales of fluorinated greenhouse gases and equipment containing such gases, as well as all records relating to the installation, maintenance, repair and decommissioning of such equipment.
P&M26	Energy Transition Fund in the industrial sector' to support the energy transition of sectors or subsectors considered to be at high risk of carbon leakage.
Main target addressed (#3)	**AIR QUALITYAND CILMATE DECREE**
Other relevant objectives or strategies addressed	
O15	Decarbonisation and improvement of air quality (connected with the Italian 'Action Plan for Air Quality Improvement')
Relevant policies and measures included	
P&M27	Within the framework of future rural development programmes, forms of funding linked to measures to ammonia abatement measures, in order to allow in the next 2021-2027 programming a greater use of such measures among farmers, with simultaneous reduction of polluting emissions.
P&M28	Amendment of the Legislative Decree 152/2006 aimed at progressively restricting the practice of burning of plant residues, also with a view to the recovery and valorisation of such residues.
P&M29	Civil heating, with measures to reduce pollutant emissions from stoves biomass and biomass-fuelled heating systems, but also restrictions on the use of oil-fired heating systems and qualification of installers of systems powered by renewable sources.
P&M30	Measures aimed at reducing pollution resulting from the biomass combustion, there are plans to updating of sector regulations to condition the incentive of replacing of thermal plants fuelled by firewood, briquettes and wood chips to the certification of these solid biofuels in compliance with the relevant technical standards by certification bodies, as well as compliance with appropriate forms of traceability and environmental sustainability criteria aimed at ensuring, for the same amount of energy produced, a reduction in pollutant and carbon dioxide emissions; b) analysis of possible restrictions on the use of biomass for the production of heat for district heating in areas characterised by particular air pollution; and district heating in areas characterised by particular air pollution.
P&M31	Closure or conversion of thermal power plants that fall within the areas covered by the infringement procedures
P&M32	Cross-cutting measures, such as the rationalisation of environmentally harmful subsidies
P&M33	Creation of the permanent inter-ministerial table on the climate emergency
P&M34	Promoting sustainable mobility in metropolitan areas
P&M35	Creation, within the above spending limit and until resources are exhausted, of a "Mobility Voucher" equal to equal to 1,500 euros for each car and equal to 500 euros for each scrapped motorbike, to be used within the next three years, for the purchase of subscriptions to local and regional public transport or of bicycles, including pedal-assisted bicycles.
P&M36	Financing of projects for the creation, extension, modernisation and standardisation of 'local public transport' lanes
P&M37	Introduction of arrangements for the promotion of 'Sustainable School Transport'.
P&M38	Actions for reforestation for an Experimental programme for tree planting, replanting and forestry and for the creation of urban and peri-urban forests in the Metropolitan Cities.
P&M39	Establishment of Environmental Economic Zones (EAZs) within the territories of national parks national parks. In these zones, in compliance with European regulations on State aid, forms of support may be granted in these areas

	to new and existing businesses that undertake a programme of economic activities or investments aimed in particular at reducing greenhouse gases, the promotion of renewable energy and energy efficiency.
P&M40	Establishment of the 'Green Italy' programme in order to promote sustainable management initiatives in Italian cities and to disseminate good practices
Main target addressed (#4)	**ELECTRIC SECTOR**
Other relevant objectives or strategies addressed	
O16	Construction of new plants and the preservation and enhancement of existing installations.
Relevant policies and measures included	
P&M41	Systems for individual and collective self-consumption: general regulation favouring instantaneous self-consumption
P&M42	Systems for individual and collective self-consumption: evolution of the on-site exchange mechanism
P&M43	Systems for individual and collective self-consumption: strengthening of the minimum share of renewable energy obligations in new buildings or undergoing major renovation
P&M44	Systems for individual and collective self-consumption: progressive and gradual extension of the requirement for a minimum share of renewable energy sources to existing buildings, starting with certain categories such as warehouses used for production activities and buildings for the third sector
P&M45	Introduce uniform simplified procedures for the construction, commissioning and operation of plants, also by extending the scope of the single model
P&M46	Expand the use of the Simplified Enabling Procedure
P&M47	Promote the installation of photovoltaic systems on existing agricultural structures that do not fall within the definition of a building, including through the introduction of the concept of rural building for access to support measures
P&M48	Enable the aggregation of small plants for the purpose of participating in the procedures for access to incentives on energy fed into the grid
P&M49	Establish specific incentive tariffs for cases where self-consumption is not feasible (...) for the combined production of electricity and heat from agro-industrial waste and residues, in particular through plants that are part of the production cycle of companies
P&M50	Introduce premiums for the realisation of photovoltaic systems whose modules are installed to replace asbestos-containing roofing
Main target addressed (#5)	**ENERGY COMMUNITIES, LARGE PLANTS** (typically power above 1 MW) **AND COMMON MEASURES FOR LARGE AND SMALL INSTALATIONS**
Other relevant objectives or strategies addressed	
O19	Promotion of energy communities
Relevant policies and measures included	
P&M51	Mechanisms of direct support on production, including from several plants (analogous to the general mechanisms for production support) and on locally consumed energy
P&M52	Renewable energy communities will be promoted primarily by enhancing the existing electricity grid and will be an instrument on one hand to support the economies of small municipalities, often rich in renewable resources, on the other to provide opportunities for local production and consumption even in those settings where self-consumption is technically difficult.
P&M53	Information tools on locally available resources and opportunities offered by support instruments

P&M54	The development of standard tools for the establishment and management of communities and for the valorisation of energy production will be also considered
P&M56	Assess the feasibility of promoting forms of aggregation and cooperation for the production and consumption of renewable energy, as well as for the provision of energy services, also in the context of production districts
P&M57	Competitive tendering mechanisms, adopting a neutrality approach between groups of technologies with similar structures and cost levels, in the market parity approach
P&M58	Widely promote the use of long-term contracts alongside contracts for difference, with regulation favouring the conclusion by investors of Power Purchase Agreements (PPAs) with parties interested in purchasing the energy that the plant will energy that the plant will produce over a sufficiently long time interval to ensure the amortisation of the investment needed to build a new production plant
P&M59	Pilot projects within the framework of the National Action Plan on Green Public Procurement Administration and procurement procedures for energy supplies through tenders
P&M60	Facilitate dialogue between parties
P&M61	Share objectives with the Regions and identification of suitable areas for the construction of the plants
P&M62	Ad hoc tools for new installations based on innovative technologies
Main target addressed (#6)	**SPECIFIC MEASURES TO SAFEGUARD AND UPGRADE EXISTING INSTALLATIONS**
Other relevant objectives or strategies addressed	
O20	Maintaining and, if possible, increasing the renewable production of existing plants
Relevant policies and measures included	
P&M63	Provide support mainly through measures of simplification and clarification of the regulatory framework, with recourse to support instruments only where such measures prove insufficient
P&M64	Simplified authorisation procedures, establishing criteria that allow for interventions with an extension of the PAS and exclusion or simplification of the EIA/screening; environmental assessment; in particular for environmental assessments, it is intended to favour an approach that substantially assesses changes in impact with respect to the ante revamping or repowering intervention;
P&M65	Revamping, repowering, converting: the establishment of basic conditions and limits under which it is possible to carry out simpler interventions simpler
P&M66	Revamping, repowering, converting: better information on plant performance conveyed by the GSE on the based on the data acquired as part of the management of the incentives
P&M67	Revamping, repowering, converting: promote the conversion of certain types of plants that at the end of the incentive period incentive period should prove to be uncompetitive on the market, in favour of plants that are more functional to the needs of the system in the path of energy transition.
P&M68	Hydroelectric production: constant dialogue with the regions themselves to promote an efficient and appropriate application of the hydroelectricity management rules, so as to ensure that it adequately contributes to the objectives.
P&M69	Hydroelectric production: ensure the availability of support instruments to promote the construction of new facilities on smaller water networks, for example by exploiting the geodetic falls of aqueducts
P&M70	Hydroelectric production: state technical regulations the qualification of plant modifications defined as 'substantial' and of those defined as 'non-substantial'
Main target addressed (#7)	**TRANSPORT**
Other relevant objectives or strategies addressed	

O21	Renewable energy breakthrough in the transport sector
Relevant policies and measures included	
P&M71	Incentives for fulfilling the biofuel release obligation through bio-methane and other advanced biofuels: 2018-2022.
P&M72	Biofuels and other renewables obligation in transposition of RED II: 2022-2030: update mandatory release quotas until 2030 for normal and advanced biofuels; introduce differentiated targets for petrol, diesel and possibly methane; introduce hydrogen from renewable sources and possibly fuels from recycled carbon in the list of biofuels and fuels that can be used for the purpose of the obligation; provide for a link with the European sustainability monitoring database; update the multipliers to be used for target calculation purposes; identify maximum percentages of first-generation of first-generation biofuels; facilitate the use of pure advanced biofuels.
P&M73	Promotion of the use of biofuels in the rail (…) including the use of renewable gases (eventually hydrogen)
Main target addressed (#8)	**THERMAL SECTOR**
Other relevant objectives or strategies addressed	
O22	Promote the use of thermal renewable sources
Relevant policies and measures included	
P&M74	Tax deductions for energy efficiency measures and the building renovation of existing buildings, both of which are also intended for thermal renewables
P&M75	White Certificates mechanism, including the promotion of High Yield Cogeneration
P&M76	Thermal Account
P&M77	Contributions to municipalities for investments in energy efficiency and sustainable territorial development
P&M78	Specific measures for regional cooperation, and optionally, the estimated surplus production of energy from renewable sources that could be transferred to other Member States
P&M79	Specific measures aimed at introducing one or more contact points, streamlining administrative procedures, provide information and training and facilitate the adoption of long-term power purchase and sale agreements.
P&M80	Assessment of the need to build new infrastructure for district heating and district heating and cooling from renewable sources
P&M81	Specific measures for the promotion of the use of energy from biomass, in particular for the new mobilisation of biomass, taking into considering the following: a) biomass availability, including sustainable biomass: national potential and imports from third countries; b) other uses of biomass in other sectors
Main target addressed	**Energy efficiency:** achieve the national indicative contributions of energy efficiency by 2030
Main target addressed (#9)	**ENERGY EFFICIENCY**
Other relevant objectives or strategies addressed	
O23	Cumulative final energy savings to be achieved over the period 2021-2030, confirmed at 51.4 Mtoe compared to 50.98 Mtoe calculated on the basis of the average final energy consumption in the three-year period 2016-2018
Relevant policies and measures included	
P&M82	the National Fund for Energy Efficiency (FNEE)
P&M83	the Business 4.0 Plan
P&M84	the Programme for the Energy Requalification of Public Administration Buildings Administration (PREPAC)

P&M85	the Programme of Energy Efficiency Interventions promoted by the Cohesion Policies 2021-2027
P&M86	the National Information and Training Plan for Energy Efficiency (PIF)
Other relevant objectives or strategies addressed	
O24	Promote energy services in the public sector and measures to remove regulatory and non-regulatory barriers that impede the introduction of energy performance contracting and other models of energy efficiency services energy efficiency
Relevant policies and measures included	
P&M87	Strengthen a number of enabling factors that are key to activating private investments such as: a) structuring and monitoring the qualification process of operators in the sector, with particular reference to ESCos; b) simplifying the authorisation process for access to incentive mechanisms; c) strengthening the monitoring of compliance with standards and regulations.
P&M88	"CantierAmbiente" measure which requires all public administrations to identify a green manager, with the aim of ensuring the proper implementation of the environmental legislation'.
OTHER relevant policies and measures included	
P&M89	Energy audits and energy management systems
P&M90	Updated the provisions for air-conditioning systems with the specific aim of progressively replacing highly emissive
P&M91	Introduction of new limits on the use of cooling systems, through the definition of constraints (e.g., days of use, hours, minimum temperatures) to be set in relation to the relation to the climatic zone of reference
P&M92	Subsidies for interventions on cogeneration plants that lead to an increase in thermal production heat output aimed at maintaining or achieving an efficient district heating system set-up
P&M93	Increase consumer awareness and the active role of consumers, by exploiting for example, the technologies of home automation, digitisation of networks and smart metering
P&M94	Structure an energy efficiency programme starting firstly with public lighting
P&M95	Collaboration between central government and local authorities on energy efficiency
P&M96	Established that the Minister of Education, Universities and Research shall define a national plan for energy efficiency measures in public school buildings
P&M97	In the programming of the Structural Funds for Italy for the periods (...) and 2021-2027, with particular regard to the European Regional Development Fund (ERDF) and the Cohesion Fund (...) and for the subsequent period 2028-2034, the priority will be directed towards the implementation of the PNIEC. Particular attention will be given to the allocation of significant resources at local and national level for initiatives aimed at the decarbonisation of the public and private building stock and measures to contain the mobility needs and the increase of collective mobility, in particular by rail, including the shift of freight transport from road to railway
Main target addressed	**Achieve energy security**
Main target addressed (#10)	**GAS SECTOR, OIL SECTOR AND ELECTRIC SECTOR, AND COOPERATION**
Other relevant objectives or strategies addressed	
O25	Ensure the adequacy and maintenance of standards of safety of the electricity, gas and petroleum products system
Relevant policies and measures included	
P&M98	Revision of the Preventive Action Plan of the Italian natural gas system according to the new Safety Regulation No. 1938/2017

P&M99	Updating of the Emergency Plan of the Italian natural gas system in a way coordinated with the Emergency Plans of other countries connected in the same corridors of reg. 1938/2017 supply corridors
P&M100	Adapting the functions of the gas transmission and storage network
P&M101	Diversification of supply sources including through Liquefied Natural Gas (LNG)
P&M102	Encourage further conversion of marginal Italian refineries to bio-refineries over the next few years, consistent with the increase in domestic demand for advanced biofuels;
P&M103	Focus on plants for the production of raw materials for the preparation of biofuels for biorefineries (so-called 'advanced feedstocks' made, for example, from algae and waste oils), in order to create a national production chain to support a transition to advanced biofuels;
P&M104	Support the re-use of industrial sites through conversion to storage or other productive investments, also in order to safeguard employment levels
P&M105	Avoid unjustified displacement of personnel, currently employed in the traditional extraction and processing of fossil products and hydrocarbons and stimulate investments to increase the conversion of heavy products from refinery processing and reduce fuel oil production, in light of the new IMO regulations
P&M106	Safeguard the Italian residual refining industry, with the aim of allowing the market to have environmentally friendly products made to the highest environmental standards.
P&M107	Updating of the Emergency Plan for Electricity System Safety (EMP)
P&M108	Increase resilience: increase interventions on assets through the meshing and upgrading of the network, including a diversification of the technologies used (for example, the use of underground cable must be carefully evaluated, as it is more resistant to adverse weather events)
P&M109	Increase resilience: In the immediate future, mitigation measures are to be envisaged, such as anti-rotational devices to prevent the effect of the ice sleeve and remote control
P&M110	Activities that network operators must put in place to reduce the time it takes to resume service, which require actions of coordination with the main actors involved (territorial authorities, Civil Protection, road of roads, etc.) and the provision of available resources
P&M111	Defence plans for the transmission grid and adoption of measures for continuous adaptation technology
P&M112	Capacity market
P&M113	Adaptation of the regulations on authorisations for thermoelectric plants
P&M114	Adaptation of national cybersecurity measures (identification of risks and actions to countermeasures)
Other relevant objectives or strategies addressed	
O26	Regional cooperation in this field
Relevant policies and measures included	
P&M115	Transboundary coordination
P&M116	Definition, with other Member States, and organisation of solidarity measures
P&M117	Coordination of the ten-year development plans of the Italian national gas pipeline network with the plans of other European TSOs and studies on the possible use of gas infrastructure also in mixture with hydrogen
P&M118	Cross-border cybersecurity
Main target addressed	**Internal energy market**
Main target addressed (#11)	**INFRASTRUCTURES FOR ELECTRICITY**

Other relevant objectives or strategies addressed	
O27	Interconnectivity
Relevant policies and measures included	
P&M119	Realization of new infrastructures with various States (at north with France, Switzerland, Austria and Slovenia and at the south-east of Europe where the productive capacity is diversified and increasing in the medium to long term
P&M120	Development of the interconnection with Africa (with the support of the EU)
Main target addressed (#12)	**INFRASTRUCTURE FOR THE TRANSMISSION OF ENERGY**
Other relevant objectives or strategies addressed	
O28	Promote an upgrading and improvement of the electricity transmission network
Relevant policies and measures included	
P&M121	Internal network developments
P&M122	Planning the development of the national transmission grid
P&M123	Development of storage systems for the safe and efficient operation of the National Transmission Grid
P&M124	Prototype approach to facilitate the implementation of innovative projects on energy networks energy networks
P&M125	Guidelines for the development of infrastructure cost recognition based on the service rendered to users
P&M126	Development of the LNG network
P&M127	Cooperation: intensification of activities within the Central and South-East European Gas Interconnection Group Central and South-East Europe (CESEC); initiatives for greater coordination of new projects and infrastructure in the Adriatic.
Main target addressed (#13)	**MARKET INTEGRATION**
Other relevant objectives or strategies addressed	
O29	Foster greater market integration with other States
Relevant policies and measures included	
P&M128	Overcoming the Single National Price (PUN)
P&M129	Development of market coupling
P&M130	Introduction of negative prices in national markets
Other relevant objectives or strategies addressed	
O30	Increase the flexibility of the energy system with regard to the production of renewable energy
Relevant policies and measures included	
P&M131	Reorganisation and rationalisation of configurations for self-consumption
P&M132	Support for configurations with self-consumption
P&M133	Deployment technology integration between vehicles and the electricity grid: vehicle to grid
P&M134	Updating the dispatching model and the role of distributors (DSOs)
P&M135	Development of continuous trading in the intraday market

P&M136	Development of PPPs
P&M137	Energy cost gap reduction for gas-guzzling industries compared to other EU countries
P&M138	Fiscal stabilization for LNG in the field of transports
Other relevant objectives or strategies addressed	
O31	Ensure the non-discriminatory participation of renewable energies renewables, demand management and storage, including through aggregation, in all energy markets
Relevant policies and measures included	
P&M139	Development of storage capacity
P&M140	Enhancement of concentrated storage systems
P&M141	Development of distributed storage systems
P&M142	Development of aggregation in the services and balancing markets
Other relevant objectives or strategies addressed	
O32	Protect consumers, especially the most vulnerable and, where applicable, in energy poverty, and to improve the competitiveness and competition in the retail energy market
Relevant policies and measures included	
P&M143	Completing the liberalisation of retail markets
P&M144	Measures in favour of energy-intensive companies to support the competitiveness of production sectors exposed to international competition international
P&M145	Consumer protection tools and measures: consumption portal and other developments in the integrated information system; new forms of non-price protection; supplier register; regulation of services of last resort;
P&M146	Tools for prosumers: the auto-consumer portal
P&M147	Reducing the spread between gas prices at PSV and Northern European HUB prices
Other relevant objectives or strategies addressed	
O33	Enable and develop demand management, including those supporting dynamic pricing
Relevant policies and measures included	
P&M148	Electricity and gas market: smart meter
Main target addressed (#14)	**ENERGY POVERTY**
Other relevant objectives or strategies addressed	
O34	Combat energy poverty
Relevant policies and measures included	
P&M149	Creation of an institutional Observatory on Energy Poverty
P&M150	Review of existing instruments, especially the electricity and gas bonuses;
P&M151	Subsidies to low-income households;
P&M152	Establishment of an efficiency programme for social housing buildings;
Main target addressed	**Dimension of research, innovation and competitiveness combating energy poverty**

P&M153	Several Policies and measures have already been deployed: Fund for Electricity System Research; Fund for Interventions and Measures for Technological and Industrial Development; Fund for the Development of Intangible Capital; Guarantee Fund; Hyper and Super Amortisation; Capital goods measure ('New Sabatini'); Grow in the South' Fund; Tax credit; Innovation Agreements; Sustainable Growth Fund; Energy Cluster; CO2 auction proceeds; Fund for investment and infrastructure development; National Innovation Fund; Prototypal approach to facilitate the implementation of innovative projects on energy networks; Cohesion Funds; Facilities to support research and development projects for the reconversion of production processes in the circular economy; Establishment of the Ministry of Innovation and the National Research Agency; Fund for financing investment programmes and projects of an innovative nature.
P&M154	Strategic Energy Technology Plan (SET Plan)
P&M155	Funds from Horizon 2020; Important Projects of Common European Interest (IPCEI)
Actuation areas	National while some measures are geographically more specific
Additional relevant information	-

11.3.4. Annex 2.4. Deep analysis of document #9 of CS2

Table 69. Document #9 of CS2 Trentino deeply analysed

Case Study	**CS2 – Mountain region Tretino (IT)**		
#9	**The Italian Long-Term Strategy for the reduction of greenhouse gas emissions |** *(IT: Strategia Italiana di Lungo Termine sulla Riduzione delle emissioni da gas a effetto serra)*		
Type of document	Strategy	**Language(s)**	Italian (and brief summary in English)
Scope	National	**Year of adoption**	2021
Web link	https://ec.europa.eu/clima/sites/lts/lts_it_it.pdf	**Target year**	2050
Brief description	The proposed National Long-Term Strategy identifies the possible pathways to achieve 'climate neutrality' in Italy by 2050, in which residual greenhouse gas emissions are offset by CO2 removals and by the possible use of geological storage and reuse of CO2. In order to quantify and qualify the effort to be made in this direction, the Strategy goes through two logical steps: • as a first step, a Reference Scenario characterised by three essential elements has been outlined: (i) it hits the targets set out in the National Integrated Energy and Climate Plan (PNIEC - document n.8), "dragging" up to 2050 the consequent virtuous energy-environmental trends; ii) it adopts exogenous GDP and population dynamics in line with the most recent sets of available ISTAT forecasts iii) it incorporates the effects of climate change, in terms of potential changes in degree days crop yields and fire frequency and highlights the consequent priority actions in terms of 'adaptation'; • starting from the emission gap returned by the Reference Scenario, it includes several exercises to identify combinations, synergies and criticalities of the potential levers that can be activated to achieve climate neutrality by 2050 (Decarbonisation Scenario). This document has been developed by ISPRA and supported by the Italian Ministries of the Environment and Protection of Land and Sea; Economic Development; Infrastructure and Transport; Agriculture, Food and Forestry.		
Sectors involved	Energy	Transport	
Main target addressed	The Italian Long-Term Strategy identifies the possible pathways to achieve 'climate neutrality' by 2050, in which residual greenhouse gas emissions are offset by CO2 removals and by the possible use of geological storage and reuse of CO2.		
Other relevant objectives or strategies addressed			

O1	**Energy demand – The final consumption must fall significantly, by about 40% compared than the current ones** (part of this reduction is already incorporated in the Reference Scenario as a result of trends triggered by the PNIEC, fully in line with the European 'energy efficiency first' principle)
Relevant policies and measures included	
P&M1	The 'annual rate of redevelopment' of buildings, with renovations predominantly 'deep' building renovation, must accelerate significantly: considering that the 2030 targets of the PNIEC call for a rate of 0.9 % for residential, while by 2050 it will be necessary to go up to about 2%, of which about 80% deep renovation.
P&M2	In the transport sector, it is expected to further increase the share of private mobility needs covered by public/shared transport, with a significant reduction in the car fleet circulating car fleet and, on the freight side, a more effective logistics (e.g., with a drastic reduction of 'empty journeys').
P&M3	The reduction in consumption must be accompanied by a **major reorganisation of the energy sources and vectors** used where a) electricity exceeds 50%, with significant peaks in some sectors (e.g., cars will be predominantly electric and buildings heated with heat pumps); b) renewables, in addition to electricity, are also growing in the form of biomethane and hydrogen, reaching, overall, no less than 85-90% of final consumption; c) development of the circular economy is assumed, to the point of marginalising the energy use of waste.
Other relevant objectives or strategies addressed	
O2	**Energy offer**
Relevant policies and measures included	
P&M4	**Electricity production should increase by more than double from today's level** and reach 600-700 TWh with a share covered by renewables of between 95% and 100%, depending on whether the or not the assumption of a complete abandonment of fossil fuels in both electricity generation and steel industry
P&M5	Deployment of previously unexploited sources, first and foremost **off-shore wind power**, and, based on the available technologies, to an **exceptional development of solar energy**: the estimated installed photovoltaic capacity by 2050 varies between 200 and 300 GW (i.e. 10-15 times that of today).
P&M6	Govern the **hydrogen vector** in a technologically effective manner technologically effective (share that can be blended into the grid with gas/biomethane, direct use in transport and industry, storage possibilities) and economically efficient
P&M7	Hydrogen derived from renewables combined with captured CO2 of 'bio' origin enables the production of biomethane and fuels similar to conventional but with zero greenhouse gas emissions (so-called e-fuels), thus favouring the re-use of existing infrastructures and vehicles. In compliance with objectives on air quality, **the potential of biomass should also be fully exploited, including of biomass, including the utilisation of wood from sustainable forest management.**
P&M8	From an infrastructural point of view, the **progressive replacement of gas with hydrogen will require an upgrading and overall reconfiguration of the network**, for example, with portions dedicated exclusively to the transport of hydrogen itself and peripheral distribution sections that could be closed (because they are served by local systems), as well as an appropriate coupling of the electricity and gas sectors.
Other relevant objectives or strategies addressed	
O3	**The non-energy sector, absorption and capture**: The room for improvement compared to the Reference Scenario is in the order of 20%, with a stock residual stock of around 50 Mton CO2 eq. far exceeding that from energy uses.
Relevant policies and measures included	
P&M9	An improvement, however relative, can be incorporated for agriculture related to **livestock management and innovative virtuous techniques to increase the stock of carbon** in soils;
P&M10	Restore the **absorption of 'sinks' to its historical maximum** of approximately 45 Mton CO2 eq. with policies to combat fires and sustainable land management

P&M11	In order to reduce the residual emissions to 'zero', i.e. an additional 20-40 Mton CO2 eq. one can resort to exploitation of part of the nationally estimated available potential for storing captured CO2 capture (CCS), particularly within industry (energy and non-energy).
Actuation areas	National level (Italy)
Additional relevant information	-

11.3.5. Annex 2.5. Deep analysis of document #10 of CS2

Table 70. Document #10 of CS2 Trentino deeply analysed

Case Study	**CS2 – Mountain region Tretino (IT)**		
#10	**Trentino Provincial Sustainable Development Strategy (Agenda 2030) |** *(IT: Strategia PROvinciale per lo Svilippo Sostanibile - SproSS)*		
Type of document	Plan	**Language(s)**	Italian
Scope	Regioal	**Year of adoption**	2020
Web link	https://agenda2030.provincia.tn.it/Documenti/Documento-preliminare-della-Strategia-provinciale-per-lo-Sviluppo-Sostenibile	**Target year**	2030
Brief description	The provincial Strategy for Sustainable Development (SproSS) is the planning document which indicates the pathway towards the implementation at provincial level of the SDGs (Sustainable Development Goals) set by the Agenda 2030.		
Sectors involved	Biodiversity and natural heritage	Tourism, cultural heritage	Agriculture, forestry and fishing
	Energy		
Main target addressed	The provincial Strategy for Sustainable Development (SproSS) indicates the pathway towards a sustainable Province of Trento at 2030, with reference to the SDGs (Sustainable Development Goals) framework. It is formed by 5 priority action areas: for a Trentino that is smarter, greener, more connected, more social, closer to the citizens. Twenty provincial sustainability objectives are identified across the five priority areas.		
Other relevant objectives or strategies addressed			
O1	Improve the governance for sustainable tourism and support the transition towards a circular and sustainable economy		
O2	Enhance sustainable tourist offers and promote service/products/activity to improve the territory attractiveness all year around		
O3	Support the improvement of accommodation facilities in terms of energy efficiency, water saving, short food supply chain, environmentally friendly cleaning products and promote the evaluation of ecologic footprint of touristic services		
O4	Promote alternative mobility of guests and residents		
O5	Protect the environment and natural resources, define and monitor the tourism carrying capacity of destinations		
O6	Promote a territorial marketing oriented towards sustainability and continuous training of operators		
Actuation areas	Trentino province		
Additional relevant information	The SproSS is a guideline document that contains the general strategies to be pursued over the next 10-15 years to implement the Agenda 2030 SDGs. The actual definition and implementation of		

	measures/policies corresponding to the aforementioned SproSS' objectives/strategies must be done in the specific sectorial plans and programmes (mainstreaming process).

11.3.6. Annex 2.6. Deep analysis of document #12 of CS2

Table 71. Document #12 of CS2 Trentino deeply analysed

Case Study	**CS2 – Mountain region Tretino (IT)**		
#12	**Environmental Energy Plan of the Trentino Province |** *(IT: Piano Energetico Ambientale Provinciale (PEAP)*		
Type of document	Plan	**Language(s)**	Italian
Scope	Regional	**Year of adoption**	2021
Web link	http://www.energia.provincia.tn.it/peap/	**Target year**	2030
Brief description	The Provincial Environmental Energy Plan (PEAP) 2021-2030 guides Trentino's energy and environmental transition. The Plan identifies 12 strategic lines declined into 83 priority actions that transversally affect various sectors. Following this path, in 2030 climate-altering emissions will be reduced by 55 percent compared to 1990, aiming to arrive, in 2050, at an energy self-sufficient province.		
Sectors involved	Energy		
Main target addressed	The document represents the Work Programme on energy of the Autonomous Province of Trento and addresses the activities towards the adoption of the Provincial Strategy for Mitigation to Climate Change. One of the activities consists in the publication of an updated Report on the Trentino energy production and consumption.		
Other relevant objectives or strategies addressed			
O1	Redevelopment of civil buildings: DEEP ENERGY UPGRADING OF EXISTING CIVIL BUILDINGS AND INCREASING INDIVIDUAL AND COLLECTIVE SELF-CONSUMPTION		
Other relevant objectives or strategies addressed			
O2	Redevelopment of the industrial sector: HIGH-EFFICIENCY INDUSTRY: ADOPTION OF HIGH-EFFICIENCY INDUSTRIAL PRODUCTION TECHNOLOGIES COMBINED WITH STORAGE TECHNOLOGIES, GENERATION FROM RENEWABLES, AND INTEGRATED MANAGEMENT APPROACHES		
Relevant policies and measures included			
P&M1	I5 Dissemination of corporate energy diagnostics		
P&M2	I7 Technological modernization and optimization energy		
P&M3	I9 Training of Energy manager		
P&M4	I10 Dissemination of management systems energy (ISO 50001)		
Other relevant objectives or strategies addressed			
O3	Sustainable mobility: PROMOTE SUSTAINABLE MOBILITY		
Relevant policies and measures included			
P&M5	MS7 Light mobility and ropeways		
Other relevant objectives or strategies addressed			
O4	Increasing renewable energy sources: INCREASE AND DIFFERENTIATION OF ENERGY PRODUCTION FROM RENEWABLE SOURCES		

Other relevant objectives or strategies addressed	
O5	Hydropower: REALLOCATION OF CONCESSIONS OF LARGE HYDROELECTRIC DERIVATIONS
Relevant policies and measures included	
P&M6	IE3 Pilot projects hydropower and climatic changes
Other relevant objectives or strategies addressed	
O6	Energy communities INCREASE DISTRIBUTED GENERATION OF ENERGY FROM RENEWABLE SOURCES, SELF-CONSUMPTION AND "SMART" MANAGEMENT OF ENERGY FLOWS IN BUILDINGS AND ENERGY COMMUNITIES
Relevant policies and measures included	
P&M7	CE1 Census of energy communities in Trentino
P&M8	CE2 Provincial coordination among energy communities.
P&M9	CE3 Coordination with the Regulatory Authority
P&M10	CE4 Activities of provincial regulatory compliance
P&M11	CE5 Energy communities and research institutions
P&M12	CE6 research Projects on energy communities
Other relevant objectives or strategies addressed	
O7	Methane EXTEND THE METHANE DISTRIBUTION NETWORK
O8	Hydrogen GREEN HYDROGEN IN TRENTINO BY 2030
Other relevant objectives or strategies addressed	
O9	Territorial and climate planning URBAN PLANNING AND CAREFUL MANAGEMENT OF THE BUILT ENVIRONMENT AS A KEY FACTOR IN ITS ENERGY PERFORMANCE AND ITS ABILITY TO BE RESILIENT TO THE EFFECTS OF CLIMATE CHANGE
Relevant policies and measures included	
P&M13	P1 Energy-climate indicators to use in urban planning tools
P&M14	P5 Methodology of energy analysis in urban planning tools
P&M15	P8 Energy analysis at the planning stage
P&M16	P9 Ordinary climate-conscious planning
P&M17	P10 Regulatory update
P&M18	P11 Implementation plans, reward and Energy Community
Other relevant objectives or strategies addressed	
O10	Research and innovation SYNERGY WITH THE RESEARCH AND DEVELOPMENT SYSTEM
Relevant policies and measures included	
P&M19	R&I1 Trentino Green Deal
P&M20	R&I2 Data Map
Other relevant objectives or strategies addressed	
O11	Mobilizing investment
O12	Citizens toward the transition

Actuation areas	Trentino
Additional relevant information	-

11.3.7. Annex 2.7. Deep analysis of document #17 of CS2

Table 72. Document #17 of CS2 Trentino deeply analysed

Case Study	**CS2 – Mountain region Tretino (IT)**		
#17	Three-year plan 2022-2024 of Trentino Sviluppo S.p.A. on **Trentino's territorial promotion and tourism marketing activities**		
Type of document	Plan	**Language(s)**	Italian
Scope	Regional	**Year of adoption**	2022
Web link	https://www.trentinomarketing.org/media/w3adxyle/pm-2022-2024.pdf	**Target year**	2032
Brief description	A strategic plan with a ten-year horizon, concern of the activity of territorial promotion and tourism marketing of Trentino, which indicates sustainability as a precondition for the future, a guiding principle of the present and a commitment for setting future models.		
Sectors involved	Tourism, cultural heritage		
Main target addressed	The Marketing Plan defines the objectives of a system that wants to be distinctive, balanced, and long-lasting, in a perspective that is not only touristic, but involves the choices and destiny of the entire Trentino territory. The macro objectives envisaged relate to the pursuit of a Trentino open 12 months a year, always alive and welcoming, seeking greater balance in the relationship between residents and tourists, and of a Trentino that is always sustainable, with better occupancy of beds/months, a strong and competitive digital ecosystem and an efficient and coordinated tourism organization. The actions that will be put in place therefore imply lasting choices and investments over time, which will allow to leave to the next generations a better territory, and are aimed at having lively and hospitable localities in the four seasons, attentive to the quality of life of residents and able to offer moments of quality experience to guests, to limit the hyper-concentration and congestion of some places and in some specific periods of the year, to mitigate the risk of falling quality, guest satisfaction and citizen impatience.		
Other relevant objectives or strategies addressed			
O1	Mobility: support to alternative mobility. Mobility during the holiday as a value: move easily on vacation, with all the mobility available and especially without (own) car.		
O2	Environment: guarantee sustainable management of natural resources, contrasting the loss of biodiversity and protecting assets.		
O3	Sustainability in food service		
O4	Human capital: the tourism industry must become an attractive economic asset with a particular look towards for the new ones, also creating new professional skills and innovative ways of working.		
O5	Corporate sustainability: making it last time everything that revolves around the hotel		
O6	Communication strategy: sustainable growth and long-term planning are the two objectives of Trentino, a place that is open by nature – where hospitality, a sense of community, respect for the environment and inclusion are in the DNA of everyday life. The long-term vision is to increasingly position Trentino - worldwide - as a lifestyle to be emulated rather than a mere destination for a holiday. A place where life is good, where respect for time and the environment is evident in the daily choices of the Trentino people, where the sense of community is alive and enriches not only the locals, but also the guests, where balance is the value to which to strive.		

Relevant policies and measures included	
P&M1	Mobility: TOYOTA project, a new mobility for areas Fiemme and Fassa (Olympics 2026)
P&M2	Environment: project Trentino Tree Agreement. This important pact with trees was born due to an abnormal wave of bad weather that occurred at the end of October 2018. Rebuilding Trentino's forest heritage it is necessary and urgent because nature is a collective good and becomes a priority become promoters of environmental sustainability practices.
P&M3	Ecoristorazione project and Trentino Food Tales project.
P&M4	Human capital: the training course "Design of the sustainable tourist offer" is intended as objective is the training of expert operators in conception, planning and management and development of integrated and sustainable tourism products. The path is strongly oriented to the world of work, thanks to the involvement as teachers and testimonials from professionals from the world of business and the collaboration, for the identification of best practices and projects to follow e share, with public bodies, Trentino Marketing and the local DMOs.
P&M5	Ecoristorazione project and Trentino Food Tales project.
Actuation areas	Generally applicable to the whole case study territory
Additional relevant information	-

11.3.8. Annex 2.8. Deep analysis of document #18 of CS2

Table 73. Document #18 of CS2 Trentino deeply analysed

Case Study	**CS2 – Mountain region Tretino (IT)**		
#18	**Dolomiti Paganella Future Lab**		
Type of document	Project	**Language(s)**	Italian, English
Scope	Local	**Year of adoption**	2020
Web link	https://www.dolomitipaganellafuturelab.it/en/home-en/	**Target year**	2030
Brief description	A project developed by local DMO (destination management organisation) and designed to decipher the changes that the community are living through, thereby making the local community of the Altopiano della Paganella more resilient, capable of conceptualizing their future and elaborating development models appropriate for current challenges.		
Sectors involved	Tourism, cultural heritage		
Main target addressed	Mission: Interpret the development of tourism on the Altopiano della Paganella as a positive force in order to establish a tenacious, cohesive, and resilient community, capable of managing the risks and opportunities that the future has in store with greater awareness and balance. It was conceived as a constantly evolving platform, unique in Italy, in order to define a balanced vision for the long-term development of tourism in collaboration with the community, based on the day-to-day convenience and quality of life of residents and visitors. The work process is articulated into different stages of consultation, involving the local community and tourists, in order to build together and share a development model that enhances the value of the local territory over time.		
Other relevant objectives or strategies addressed			
O1	New generation: The younger generations have chosen to live, work, raise families, and invest in the Altopiano della Paganella as a valid alternative to urban life.		
O2	Climate change: Already for some time climate change has been acknowledged as an inevitable challenge and our holiday resort has responded by adapting and reacting in time. The tourist product has overcome the concept of seasonality. Skiing is no longer the sole protagonist in winter season and new options and experiences have been		

	developed for mountain visitors throughout the year. This evolution was possible because we started seriously designing and innovating a mountain tourism "unbounded by the seasons"
O3	Tourism balance: There is widespread appreciation and reciprocal commitment from visitors, residents, and all the tourist community, for the need to adopt sustainable behaviours. To achieve this, we have changed the way we define the success of our resort: from crude numeric analysis of arrivals and bed nights, to more incisive measurements like the socioeconomic impact of tourism, the quality of life of residents, and a different conception of seasonality. We have also managed to make the Dolomiti Paganella one of the first mountain resorts truly accessible without using a car. While tourism remains the main source of income for the community, it now plays a more balanced role in the local economy. We have achieved the transition from a holiday resort dependent on tourism, to a destination powered by tourism.
O4	Destination DNA: Analysis of which features had characterized the DNA of the tourist area up to now and which could (or should) remain characterizing features in the future. Reflection on the past, present, and future of the resort, seeking to establish what current areas of success to take into the future, as well as things to have in the future that are lacking today, and which of these it should work on.
Relevant policies and measures included	
P&M1	**Dolomiti Paganella Membership Program** Tourists have always been treated as guests. Today tourists need to become temporary residents who have the local territory at heart, acting with us to protect it. Visitors will immediately be aware of their participation in local development. When they arrive they will symbolically sign our Values Charter, when they can dedicate their visitors' tax to the initiative that they consider of highest priority among those listed in the Projects Catalogue. Benefits: a holiday in the territory will be lived (and remembered) as an experience that improves personal lifestyles. This new lifestyle can be sustained throughout the year using Dolomiti Paganella Card. This will offer our visitors affiliations with national and international brands that share the same values, enabling them to make sustainable, discounted purchases from their own homes.
P&M2	**Smart Destination Management** Visitor numbers and nights are inadequate parameters for measuring the operation of the holiday resort we want to become, and for the level of user satisfaction we want to provide. The objectives for tourist sustainability in the area can only be achieved through commitment to different parameters. The aim will not be to increase income flows, but a more balanced management of internal flows across the entire territory and in all seasons. It will be defined a new performance index that will take economic and environmental impact into account, along with implications for the reputation of our holiday destination. It will be developed an intelligent platform capable of real-time monitoring of flows to tourist attractions and services, in order to enable more effective and shared management of the same, as regards both provision and utilization by visitors. Benefits: reduce the problem of tourist overcrowding in specific areas and new approaches to managing the territory.
P&M3	**A circular tourist system** It will be created a set of guidelines and projects for the local community that implement concrete sustainable practices. It will be distributed an unusually designed bottle that will encourage tourists and residents to drink tap water. A team of volunteers will collect litter in natural areas, it will be created novelty gift items from waste materials, and it will be implemented a waste food monitoring system, donating excess food to needy social groups among the residents of Trentino. Benefits: the measures and initiatives to be adopted aim not only to reduce the physically negative aspects of tourism. There will also be "implicit" communications, inducing our tourists to move towards the ideal of a waste-free holiday
P&M4	**A manager for balanced community development** The APT will appoint a Sustainability Manager, who will support private and public stakeholders in holiday resort for the realization of shared projects that establish a more balanced form of tourism for the future. The Manager will be part of the APT, but also a resource for the entire community.

P&M5	**Dolomiti Paganella Flexible Mobility** The challenge is to open up to a new and sustainable way of moving around the area, which is also extremely comfortable and free. At the same time, reduce the isolation and travel difficulties experienced by the community, especially during the low season. It will be developed an innovative new mobility system for residents and tourists. Visitors will be encouraged, through suggestion and incentives, to leave their cars in the accommodation garages in order to enjoy a holiday resort without traffic. This proposal is not based only on shared sustainability, but also provides added value in terms of convenience, wellness, and green incentives and bonuses. It will be developed an App that enables every member of the community to offer and find "lifts" between the various centres of the territory, or to the city of Trento.
P&M6	**New Generation Tourism Commission (NGTC)** Creation of a "New Generation Tourism Commission" consisting of young people under 35 who can assess the design of tourist development through application of a new evaluation system. The Commission will serve to motivate the aggregation of young business people in the area, initiating training courses and support in the spheres of digitalization and innovation for local tourist operators.
P&M7	**A season-free destination** It will be pursued a "seasonless" mountain strategy that no longer distinguishes skiing from other outdoor activities will make the destination more competitive over the coming decades. It will be diversified the options, taking advantage of those less dependent on the seasons, with the integration of ski lifts, runs, and infrastructures with other summer and winter outdoor activities, conceptualizing their use beyond the traditional seasonal approach. All this will be done in coordination with a more balanced flow of tourists for each attraction and each specific zone.
P&M8	**Dolomiti Paganella Innovation Hub** It will be created a Dolomiti Paganella incubator that encourages the founding or local relocation of companies focused on an innovative mountain economy. The incubator will also offer co-working opportunities for local professionals. Benefits: Dolomiti Paganella will become a nerve centre for projects, interactions, and experimentation focused on the changing economy and Alpine society. The Laboratory will attract companies operating in tune with the sustainable development of our area, and stimulate new generations of residents to plan a future within our local territory.
P&M9	**Masterplan for the architectural and landscape development of localities** It will be established a Strategic and Architectural Development Plan for the places in which live every day. The Plan will certainly include the basic modern parameters for quality of life, like provision of cycle paths, venues for social aggregation and cultural production/consumption, public squares, and residential accommodation. At the same time the Plan will achieve all of this starting from the perspective of strengthening a shared sense of community.
P&M10	**Transformative Destination Storytelling** The principles of the Values Charter will guide the layout and contents of a new Internet website and Dolomiti Paganella social channels, as well as the communications of everyone active in our holiday resort. It will be created an incentives system (e.g., using discounts) on the new portal to encourage sustainable choices during the booking process (e.g., reaching the resort without a car). All the positive achievements across the whole territory and among individual operators will be reported.
Actuation areas	Small areas of Trentino (Altopiano della Paganella)
Additional relevant information	-

11.3.9. Annex 2.9. Deep analysis of document #25 of CS2

Table 74. Document #25 of CS2 Trentino deeply analysed

Case Study	**CS2 – Mountain region Tretino (IT)**		
#25	**Water Quality Protection Plan (2022-2027) |** *(IT: Piano di tutela delle acque)*		
Type of document	Plan	**Language(s)**	Italian
Scope	Regional	**Year of adoption**	2022
Web link	http://www.appa.provincia.tn.it/pianificazione/Piano_di_tutela/pagina36.html	**Target year**	2027
Brief description	The Water Quality Protection Plan represents a water resources plan that specifies and details at the local level strategies and measures to protect water quality in Trentino (Water Framework Directive 2000/60 CE).		
Sectors involved	Water and waste	Agriculture, forestry and fishing	Biodiversity and natural heritage
	Energy		
Main target addressed	Maintenance and/or improvement of biological and chemical quality of water bodies (rivers, lakes and ground waters).		
Other relevant objectives or strategies addressed			
O1	Increase the flexibility of waterworks and wastewater treatment to fluctuations of the user		
O2	Construction of water accumulation basins		
O3	Seasonal adjustment promotion		
Relevant policies and measures included			
P&M1	Tourism: to adapt snowmaking practices in terms of production technologies and reservoirs according to climate scenarios.		
P&M2	Tourism: Promotion of sustainable snowmaking practices, such as snow farming techniques to conserve natural snow accumulated during propitious seasons		
P&M3	Increasing the resilience of hydropower generation systems		
P&M4	To increase the maximum derivation capacity from watercourses, for the purpose of water storage especially during flood events, to allow water to be more fully utilized for energy production in deferred time.		
P&M5	To introduce new models of water resource management		
P&M6	Investigation of perennial and temporary hydrological regimes: analysis of the effects of climate change on natural runoff scarcity and drought and adjustment of monitoring plans		
P&M7	Definition of criteria for strengthening integration in territorial planning and sector planning		
P&M8	Identification of areas vulnerable to desertification in order to adopt specific protection measures		
P&M9	Identification of new management paradigms of water resources at the district scale that take into account future possible climate and socio-economic scenarios		
Actuation areas	The plan is applicable to the whole territory of Trento province		
Additional relevant information	In summer, the likely increase of tourism requires more water for potable use which may conflict with greater demand for agricultural irrigation and the need to keep reservoirs in operation for hydroelectric production due to an increasing energy demand for cooling. In winter, the greater shortage of natural snow will impose an increasing demand for water from ski resorts for storage in snowmaking reservoirs at high altitudes and to produce artificial snow that may create conflicts situations in lean winter periods.		

11.3.10. Annex 2.10. Deep analysis of document #27 of CS2

Table 75. Document #27 of CS2 Trentino deeply analysed

Case Study	**CS2 – Mountain region Tretino (IT)**		
#27	**Research and Innovation Strategy for Smart Specialisation 2021-2027 (of the Autonomous Province of Trento) |** *(IT: Strategia per la specializzazione intelligente 2021-2027" (della Provincia autonoma di Trento)*		
Type of document	Strategy	**Language(s)**	Italian
Scope	Regional	**Year of adoption**	2021
Web link	https://www.provincia.tn.it/Argomenti/Focus/Strategia-di-Specializzazione-Intelligente-S3	**Target year**	2027
Brief description	The Smart Specialisation Strategy is the instrument regions and Autonomous Provinces such as Trentino must adopt to identify objectives, priorities and actions to maximise the effects of the investments in research and innovation, aiming to concentrate resources on the areas of specialisation characteristic of each territory for the use of resources from structural funds. It outlines priorities for future development with the aim of creating a competitive advantage, concentrating investments in their own strengths in research and innovation, aligning them with business needs, avoiding duplication and fragmentation of efforts.		
Sectors involved	Energy	ICT	
Main target addressed	Starting from an analysis of the European, national and the Provincial context, from the analysis of strengths and weaknesses of the system in Trentino and the challenges outlined (also based on the results of the stakeholder dialogue) the document "Smart Specialisation Strategy - S3 2021-2027" identifies: • priority trajectories and key enabling technologies (KETs) within the following areas: 1. Sustainability, Mountains and Energy Resources; 2. ICT and Digital Transformation; 3. Health, Nutrition and Lifestyles; 4. Smart Industry; • actions to improve the research and innovation system; • measures to strengthen interregional cooperation; • the governance, monitoring and evaluation of the strategy.		
Main target addressed (#1)	**INNOVATION**		
Other relevant objectives or strategies addressed			
O1	Closing the gap with Europe's most innovative regions		
Relevant policies and measures included			
P&M1	Increasing the awareness of companies of the importance of defining a medium- to long-term innovative strategy		
P&M2	Increase investment in digital transformation in all sectors, promoting the use of ICT, IoT technologies and data (big data and open data) for the development of the economy and society.		
P&M3	Enhancing the supply chains and the relationship between various production and technology sectors, proposing an increasing innovative processes via priority pathways considered cross-sectoral and relevant for the area's economy.		
P&M4	Strengthening collaboration processes between companies, universities and research organisations		
P&M5	Promoting the adoption of new production and organisational models also focused on sustainability and circular economy		

P&M6	Stimulate inter-regional cooperation both at national and European level between companies and with the world of research, in order to develop strategic territorial supply chains, attracting locally partners of primary importance, seizing EU opportunities as far as possible.
Other relevant objectives or strategies addressed	
O2	Increasing enterprises and employment in the medium/high-tech and in knowledge-intensive services
Relevant policies and measures included	
P&M7	Support start-ups and spin-offs, strengthen relations between companies and the research system, strengthen entrepreneurial networks.
P&M8	Facilitating testing and monitoring activities on technologies and project ideas developed in the area thanks to: • strengthening digital infrastructure (ultra broadband, 5G, LoRa networks, etc.); • enhancement of existing co-innovation and innovation laboratories at research centres or to be created from scratch; • development of innovative methodologies that enable companies or the public administration to test technologies before investing ('test before invest'); • direct involvement of citizens for the possible release of data (pact with citizens, self-sovereign identity); • testing, monitoring and disseminating the results of research activities to citizens (citizen science, living labs, etc.) and the signing of strategic territorial partnerships, which make it possible to acquire critical mass for future experimentation, expanding the boundaries of the territory.
P&M9	Opening up new internal market perspectives stimulated by innovative public sector demand: to meet increasingly complex social challenges in a context of growing reduction of public resources.
Other relevant objectives or strategies addressed	
O3	Lack of skilled workers in emerging economic sectors
Relevant policies and measures included	
P&M10	Enhancing human capital
Other relevant objectives or strategies addressed	
O4	Improve the public-private relationship in order to make the province a favourable environment for innovation
Relevant policies and measures included	
P&M11	Fostering collaboration between business and PA
P&M12	Support the design, testing and implementation of a coherent ecosystem of secure, multilingual, cross-border digital service infrastructures interoperable across borders or sectors within public administration
Other relevant objectives or strategies addressed	
O5	Promoting inclusive growth
Relevant policies and measures included	
P&M13	Supporting social innovation, supporting projects that respond to major social challenges with new welfare models and an inclusive approach.
Main target addressed (#2)	**SUSTAINABILITY, MOUNTAINS AND ENERGY RESOURCES**
Other relevant objectives or strategies addressed	
O6	Circular bio-economics
Relevant policies and measures included	

P&M14	Re-use of waste and by-products of wood processing (e.g., wood chippings).
P&M15	Support for agro-energy and renewable energy (biogas and biomass)
P&M16	Production of materials used in production cycles (e.g., bioplastics for agriculture) and sustainable and recyclable packaging (paper, wood, plastic glass, etc.).
Other relevant objectives or strategies addressed	
O7	Sustainability in production processes
Relevant policies and measures included	
P&M17	Rational use of materials and packaging
P&M18	Measuring the sustainability of production processes (e.g., life cycle assessment - LCA).
Other relevant objectives or strategies addressed	
O8	Systems and technologies for the conservation and protection of resources
Relevant policies and measures included	
P&M19	Protection of soil (organic matter content, fertility, carbon storage, soil quality, pollution and from hydrogeological disruption), water (also pollution), forests and related biodiversity with attention also to meteorology and combating climate change.
P&M20	Conservation, protection and regeneration of the environment and ecosystems (forests meadows/grasslands, etc.) and biodiversity (micro- and macro-biota, fauna and flora).
P&M21	Protection from invasive exotic species.
P&M22	Hydrogeological safety, glacier and snow conditions to ensure the viability of the province.
Other relevant objectives or strategies addressed	
O9	Renewable Energies: production, management and storage
Relevant policies and measures included	
P&M23	Development and optimisation of renewable energy sources (RES) from natural elements, including hydraulic, solar photovoltaic, solar thermal, wind biomass and heat extracted from the ground via heat pumps, hydrogen from renewables.
P&M24	Development of energy management models such as ENERGY COMMUNITIES and POSITIVE ENERGY DISTRICTS that integrate different renewable energy sources that are managed in a coordinated manner.
P&M25	New storage systems: BATTERIES and HYDROGEN. Batteries are mainly intended for mobility, while hydrogen can be used for both mobility and stationary purposes.
Other relevant objectives or strategies addressed	
O10	Smart systems for sustainable mobility
Relevant policies and measures included	
P&M26	Smart systems for sustainable and connected mobility to improve traffic flows traffic, citizen and tourist mobility and logistics. They include both vehicles and ICT systems for management, integration and communication.
P&M27	Public transport: Electric or alternative fuel vehicles (e.g., natural gas and biofuels) and the availability of multimodal and integrated options, also favouring connections with neighbouring territories.
Other relevant objectives or strategies addressed	
O11	Smart Systems and energy efficiency (Smart grids and smart buildings)
Relevant policies and measures included	

P&M28	Smart systems, digital systems that support the management of buildings and facilities, including electricity grids.
P&M29	Application of energy-efficient technologies in processes and industrial buildings.
P&M30	Development of energy efficiency systems and related technologies, devices and materials that improve energy performance and sustainability energy performance as well as the insulation, ventilation, comfort and healthiness of buildings.
Main target addressed (#3)	**ICT AND DIGITAL TRANSFORMATION AREA**
Other relevant objectives or strategies addressed	
O12	Advanced computing and data
Relevant policies and measures included	
P&M31	Platforms and projects based on big data and open data approaches.
Other relevant objectives or strategies addressed	
O13	Digital transformation for the economy
Relevant policies and measures included	
P&M32	Development of new models for the collection, management and exploitation of data with the aim of improving digital services, including those on the ground, and contributing to the growth of the provincial production system.
Other relevant objectives or strategies addressed	
O14	Technologies for tourism and sports
Relevant policies and measures included	
P&M33	Experimentation of new technologies in the tourism and sports sectors.
P&M34	Trentino as an experimental laboratory for innovative applications of technologies, also in view of the Winter Olympics, to offer a quality service and evolve the relationship with guests.
Main target addressed (#4)	**ACTIONS NEEDED TO IMPROVE THE 'RESEARCH AND INNOVATION' SYSTEM**
Other relevant objectives or strategies addressed	
O15	Identifying actions and interventions to be put in place to improve the provincial innovation system
Relevant policies and measures included	
P&M35	Acquire analyses, studies, databases and technological foresight concerning innovative trends global trends and the introduction of digital methodologies, based on cutting-edge technologies, for the analysis of ecosystems
P&M36	Develop research and innovation ecosystems, attracting territorial projects innovative projects
P&M37	Build and promote industrial research infrastructures
P&M38	Strengthen collaboration processes between companies, universities and research organisations
P&M39	Support industrial research and experimental development projects: support on-site testing and experimentation of new technologies
P&M40	Foster the emergence of innovative start-ups, spin-offs, incubators and accelerators attract innovative enterprises and territorial projects
P&M41	Foster collaboration between businesses and PA and open up new prospects for the internal market stimulated by innovative demand from the Public Administration itself

P&M42	Position Trentino in national, European and international networks and networks encourage internationalisation processes of enterprises, supply chains and clusters encourage access to credit
P&M43	Support training interventions in favour of human resources to support enterprises in meeting competitive challenges, especially in terms of advanced digital skills
P&M44	Interventions in support of social innovation to be fully placed in the reality Trentino as an intelligent community
Actuation areas	The actuation of this Strategy is at the regional scale/Autonomous Province of Trento
Additional relevant information	-

11.3.11. Annex 2.11. Deep analysis of document #18 of CS2

Table 76. Document #28 of CS2 Trentino deeply analysed

Case Study	**CS2 – Mountain region Tretino (IT)**		
#28	**GSTC certification (Global Sustainable Tourism Council)**		
Type of document	Other	**Language(s)**	Italian, English
Scope	Local	**Year of adoption**	2019
Web link	https://www.gstcouncil.org/valsugana-tourism-board-joins-gstc/ https://www.visitvalsugana.it/it/area-operatori/2022/gstc-certificazione-di-sostenibilita/	**Target year**	3-year renewal of certification
Brief description	In 2019, the Valsugana territory received the GSTC certification, becoming the first tourism destination in Italy to be certified for environmental sustainability and social responsibility according to the criteria and standards of the Global Sustainable Tourism Council (GSTC). The path towards sustainability and conscious and quality tourism offer, undertaken in 2018 by the APT (Agency for Tourism) Valsugana Lagorai, was characterized by an innovative method of confrontation with participatory dynamics. It encouraged active exchange among those who deliver services for citizens and tourists according to positive and sustainable models: responsible tourism, ethical impact assessment on economic and social development strategies, protection and enhancement of cultural heritage and the environment. The GSTC is an independent, neutral, non-profit organization representing a variety of members globally, including the World Tourism Organization (UNWTO), NGOs, national and local governments, and operators of various kinds, united by a desire to achieve best practices in sustainable tourism. It has developed the reference standards for the two Sustainable Tourism Certifications (GSTC C-HTO and GSTC CD). The criteria underlying the Global Sustainable Tourism Council (GSTC) certification were defined from the United Nations' 17 Sustainable Development Goals, which have been translated into more than one hundred concrete and specific indicators for tourism destinations, tour operators and accommodations. The certifications, which are globally recognized and valid for 3 years, allow tourism facilities and destinations to demonstrate their commitment to implement and promote a sustainable management system from governance, environmental, social and economic perspectives.		
Sectors involved	Tourism, cultural heritage	Society	
Main target addressed	To certify the other three territories that are part, with Valsugana, of the Area Territorial Agency (ATA) Cities, Lakes and Highlands, to become the first sustainable tourism district. The other three territories are the Trento and Rovereto area and the Cimbri highlands. For the Valsugana territory, the goal is to move on to phase 2 of the certification, concerning accommodation facilities.		
Other relevant objectives or strategies addressed			

O1	Target investments toward the implementation of tourism services that respect the environment and host communities.
O2	Adopt community and participatory logics in the definition of development actions, as the key to access for a conscious and quality tourism.
O3	Make the community ambassadors of the sustainable lifestyle of an area, to be shared and promoted.
O4	Maximize social, economic and environmental benefits and minimize negative impacts for the host community and the territory.
Actuation areas	Small area of Trentino (Valsugana) but certification being extended to three other territories, all part of the Area Territorial Agency (ATA) Cities, Lakes and Highlands.
Additional relevant information	-

11.3.12. Annex 2.12. Deep analysis of document #18 of CS2

Table 77. Document #29 of CS2 Trentino deeply analysed

Case Study	**CS2 – Mountain region Tretino (IT)**		
#29	**European Charter for Sustainable Tourism (CETS) phase III**		
Type of document	Other	**Language(s)**	Italian, English
Scope	Local	**Year of adoption**	2023
Web link	https://www.ufficiostampa.provincia.tn.it/Comunicati/Alle-APT-del-Parco-Naturale-Adamello-Brenta-la-Carta-europea-del-turismo-sostenibile-nelle-aree-protette	**Target year**	-
Brief description	The five agencies for tourism (APTs) that belong to the Adamello Brenta Nature Park have obtained recognition of the European Charter for Sustainable Tourism in Protected Areas (CETS) - PHASE III, an internationally recognized tool for the management of sustainable, responsible and quality tourism in fragile environments such as protected areas. The European Charter for Sustainable Tourism (CETS) is a recognition granted by the EUROPARC Federation, an organization that brings together European protected areas and has defined its own methodology for sustainable tourism development. CETS is based on voluntary commitments and agreements among the actors involved in defining a local strategy for sustainable tourism, defined as any form of tourism development, proposal or activity that respects natural, cultural and social resources, and contributes positively and equitably to the economic development and satisfaction of the people who live, work or stay in protected areas.		
Sectors involved	Tourism, cultural heritage	Society	
Main target addressed	The certification of the APTs represents the third and final stage of the path taken by the territory within the European Sustainable Tourism Charter, an instrument that is divided into three stages, each corresponding to specific subjects. After Phase I related to the certification of the Park itself in 2006 (now in its third revalidation), in 2015 the protected area activated Phase II with the assignment of the Charter to accommodations that had become partners of the protected area in reducing environmental impacts. The goal was for tourism to make a positive contribution to developing a "virtuous" economy that promotes and develops local potential and resources. Among the parameters to be met were those related, for example, to energy saving, proper waste disposal, but also to the enhancement of local products and the assistance provided to tourists so that they can have an experience under the banner of sustainability.		

	Phase III relates to tour operators. In Trentino, also by virtue of the attributions recognized by the provincial legislation, the first subjects to access recognition are the APTs, which deal with not only the promotion of the territory but also the development of the product and its marketing.
Other relevant objectives or strategies addressed	
O1	make structural the coordinated planning between protected area and ApT of tourism products, experiences and activities that are sustainable and related to the enhancement of the natural peculiarities of the considered territory.
O2	Initiate an ongoing collaboration between protected area and ApT for the promo-marketing of these products, experiences and thematic vacations focused on the Park and its values.
O3	Network the available services by supporting the guest in enjoying the area while impacting less on the environment and enhancing the economy of the mountain communities that live these areas.
Actuation areas	-
Additional relevant information	-

11.4. Annex 4. Case Study 2 – Mountain Region (Trentino): PESTLE results for the local ecosystem drivers' analysis

The Trentino Case Study did realize the three PESTLE activities. The first one took place during the physical consortium meeting in Sitia, whose inputs can be seen in Figure 206. In that exercise, the PESTLE was done in a broader way, not only to consider the drivers (as positive things already in place) but also including challenges, which serve as basis for the goal definition in the last exercise from this PESTLE activity.

Figure 206. Trentino PESTLE analysis of local ecosystem drivers (activity during Sitia project meeting)

Then, a contrast exercise was performed by the Local Council of Stakeholders, from which the following outcomes were obtained (Table 78).

Table 78. Trentino PESTLE analysis of local ecosystem drivers – input from Local Council Stakeholders

Trentino CS POLITICAL local drivers
Willingness of local authorities to prevent further exploitation of the environment and to stop unnecessary activities that cause global warming
Finding solutions to respond to the effects of climate change
Traffic restriction policy, plastic use restriction, public water privatisation restriction....
The Tourism Service's plan to create a Working Group
Willingness of local authorities to make sustainable choices
Urban and sectoral planning, obviously linked to a political context that recognises the changes underway. Planning mountain use adapted to the changes taking place (critical localisation of facilities free from local constraints)
Policy guidelines to improve knowledge of the climate crisis in general, at school level and among the general public

An Alpine area that, given the obvious impacts of climate change, requires decision-makers to act beyond their wishes
Reversing the depopulation of the valleys to keep the mountain territory and its traditions alive, facilitating the purchase of first homes. Protect the territory with restrictive land-use plans that do not jeopardise the development of 'healthy' tourism.
Trentino CS ECONOMIC local drivers
The promotion of self-production activities that allow a clear cut in emissions
Available funding for climate change adaptation actions…
Rewards for recycling. In Norway, for example, a small refund, a few cents, is given for each whole can returned.
The work of the APTs (Tourism Consortia)
The need to innovate the mountain business model
Possibility of aid for all users to modernise facilities
Good general economic conditions (spending capacity to devote to adaptation policies); private entrepreneurship and appropriate and well calibrated incentive or trigger mechanisms so as not to 'anaesthetise' entrepreneurial capacity
Taxes to reduce high-impact actions (high cost of parking in central city areas) and facilitations for low-impact actions
Economic actors' awareness of the cost of inaction compared to the cost of adaptation.
Economic incentives to small companies that are involved in keeping traditions and thus the identity of the territory alive.
Trentino CS SOCIAL local drivers
Enhancing the self-organisation of individuals and communities
Interest of the various sectors of the local community in making their contribution
Education in schools
Safeguarding the population living in the valleys, which are heavily dependent on tourism
Creating a transport network to reduce travel by own means
Widespread culture through schools and information campaigns; training in the decision-making sectors of both the administration and investors
All useful actions to improve AWARENESS of the climate crisis (public events, education at school level)
Presence of a rich social fabric of associations, cooperatives, networks, etc. that do advocacy on the environmental issues they care about.
Strengthen and improve aggregation areas, fostering relations between broad subjects
Trentino CS TECHNICAL local drivers
Recovery of ancient know-how that enabled survival in times of crisis
Local players involved in Research and Innovation activities on climate change adaptation/mitigation
The necessity to find new solutions and a business model of integrated hospitality-facilities-services that is designed for the benefit of the destination
Financing trials to ensure that facilities are self-sufficient
Technical solutions to store water at high altitude for multiple use; solutions to reduce energy consumption related to mountain use
High density of research centres dealing in various capacities with climate change
Greater involvement of universities and research institutes.
Trentino CS LEGAL local drivers
Legislation banning emissions related to activities that are not strictly necessary

Protected areas with a specific legal framework in the territory
Tourism Law
Tourist taxT
Stimulating and incentivising transition
Reassess the limits of infrastructures with protected areas, eliminating preconceived (a priori) constraints in favour of specific assessments supported by the continuous monitoring of effects. Regulatory simplification, always valid in our Italian and Trentino contexts
Future climate change mitigation and adaptation strategy to be incorporated into sectoral plans and programmes. In addition to the presence of increasingly ambitious European targets.
No obligations, virtuous gestures must be rewarded and disseminated.
Trentino CS ENVIRONMENTAL local drivers
A generalised project for self-production of food and fuel that radically cuts the need for movement and transport of people, goods and fuel and in this way reduces climate-changing emissions
All climate change affecting everyone
The issue of water at high altitudes, increasingly less and mountain huts that are beginning to ration
The development of high-altitude reservoirs for snowmaking
The European spruce bark beetle
The crashes
Improving and mitigating heat islands within large cities and towns and creating green systems as much as possible with reduced water requirements
Integration between infrastructure projects; implementation of ESG strategies in the processes; integration between programmable (hydro) and non-programmable (photovoltaic) renewable energy sources
The increasingly severe and evident impacts lead to greater awareness and determination to act more promptly, since Trentino's exposure to risk and vulnerability are high (competing uses of water; tourism, hydroelectric and agricultural industries)
Awareness-raising campaigns for the entire population on the issues of waste reduction and reuse and consumption of key non-renewable sources.

All in all, a final exercise gathering inputs and collective feedback around the different drivers around each aspect was done, with a prior reflection on the case study vulnerable sectors, challenges and goals to overcome those challenges (Table 79), in order to set the basis for the final brainstorm on local drivers that can facilitate or enable the design and deployment of different policies at the case study.

Table 79. Trentino CS analysis of challenges and goals related to CS vulnerable sectors to serve as basis for the PESTLE analysis of local ecosystem drivers

TRENTINO VULNERABLE SECTORS
Energy
Tourism, leisure and cultural heritage
Water and waste
Biodiversity and natural heritage
CHALLENGES (mainly related with the vulnerable sectors)
Lack of a full community awareness at climate change issues
Over tourism in some sites and in some periods
Variations on tourism seasons given by modification of the seasonal snow-cover dynamic (variability of snowfall and of the snowfall duration on ground)

A significant reduction in both the duration of snow cover and average seasonal snow depth, with different responses to climate change for low and high-altitude sites. Strongly marked trends of decreasing snowfalls for the locations on the valley bottoms, whereas snow cover is quite stable above 2000 m
High electricity consumption in the tourism sector and ski resorts, due to artificial snow-making, affecting energy and water use
Competition over resources - particularly water
Dramatic seemingly unstoppable melting of glaciers and permafrost degradation
Increase in extreme events (extreme precipitations, floods, drought events, landslides, wind storms, urban heat waves, etc)
Increase of rescue interventions due both to the growth of natural events and of not properly knowledgeable tourists
Basins located at lower or wider altitudes (e.g., the basins of rivers on the valley bottom) show negative flow variations, especially in summer
Rising temperatures - Alps are hotspots of marked temperature increase especially in the settlements at valley floors
Difficult predictability for precipitation patterns
Lack of coordination and integrated actions to climate change related issues
Climate change is causing direct and indirect impacts on the economy, on natural resources, to safety and wellbeing of local communities
Evidence of permafrost degradation
Adaptation strategies are based on increasing the resilience of economic sectors but in some particular cases those clash with mitigation strategies
Data availability and its application for decision making
GOALS (to overcome the challenges)
Promote cultural change and the creation of awareness. Promote a vision that aims not only at new tourism models compatible with climate change but towards new ways of living in mountain territories where great value is placed on natural resources, an approach that fosters regaining a relationship between man and nature. Promote dissemination on climate change through communication. Formulate a positive vision in terms of opportunities and not just threats. An approach that nevertheless should convey the urgency of dealing with change.
Foster a change towards a more balanced tourism model with management of tourism flows, new visions and new products for a 12-month destination. The aim is to be able to maintain the economy of the Valleys and continuously ensure that tourism can represent a sector that can foster value creation and development.
Keeping land safety and the fruition of the outdoor (es. trekking paths) in safe conditions
Consider the usage optimization of important resources such as water and energy. Support the conciliation of concurrent use of resources with possible win -win strategies. Support the reinterpretation of management models particularly for touristic locations and mountain huts.
Develop policy recommendations for integrated and dynamic policies among diverse sectors
Foster collaboration between sectors by encouraging listening, coordinating actions on key issues, promoting sharing between different categories, and avoiding compartmentalizing.

Table 80 concludes with the final outcomes of the PESTLE analysis performed for the Trentino case study, considering also all previous inputs from the other activities as well as the basis of the vulnerable sectors, challenges and goals.

Table 80. PESTLE analysis of local drivers of Trentino Case Study (final activity)

POLITICAL TRENTINO CS local drivers	***Secondary aspect**
Being an Italian Autonomous Province (the governmental competencies for the Autonomous Province of Trento are wider than those of other Italian regions: PAT enjoys a wide legislative, administrative, and financial autonomy in all the most important fields of public government)	
Local political framework in favour of mitigation and adaptation solutions (new legislation, new incentives, etc. (especially the Provincial Strategy for Sustainable Development-SPROSS, the Provincial Energy and Environmental Plan and the New Provincial Climate Adaptation Strategy to be published by the end of 2023)	
Land use plan for protected areas, natural parks, etc.	
A destination management more oriented to the sustainable approach (for the tourism sector)	
Involvement in the EUSALP	
ECONOMIC TRENTINO CS local drivers	***Secondary aspect**
Local public incentives for renewable energy installations, energy storage, energy efficiency, energy communities, sustainable mobility, water storage, etc.	
Local public incentives that help privates in purchasing energy-powered vehicles (periodically activated)	
Private investments for energy and water efficient/sustainable solutions	
Private initiatives of local enterprises on corporate sustainability, green community, etc.	
Increasing need for artificial snow and hence energy demand on mountain stations in the latest years	
A path towards the first certified sustainable tourism district	
National Recovery and Resilience Facility Funds PNRR in Trentino (As of June 2023, the estimated ceiling of PNRR resources already allocated or in the process of being allocated to Trentino amounts to approximately 1.6 billion euros, including resources for the Trento railway bypass)	
Sustainable management of tourist flows (e.g., manage the increase of tourism demand for the summer)	
Promotion of innovative winter activities, not only related to ski and snow	
SOCIAL TRENTINO CS local drivers	***Secondary aspect**
Promotion of sustainable awareness through training and introduction of the sustainable manager in private and public companies (e.g., support for the training of Energy Managers in the PEAP, training for tourism service operators, etc.)	
Local associations promote knowledge on energy efficiency and energy communities	
Local eco-museums and associations of the civil society raise awareness on the environment and climate change	
The local Environmental Agency together with an NGO promoted the development of Youth Adaptation Strategies that will propose policy recommendations to the Provincial Climate Adaptation Strategy	
Increased interest in the development of smart-working (for residents) and of *workation* for mountain areas (*workation* = working and vacation)	
Depopulation of mountain territories	
Tourism Consortia business models: from Agency for Tourism (core on touristic aspect) to Agency for the Territory that takes care of the whole territorial needs (not only touristic needs)	
The promotion of more sustainable corporate legal form (e.g., “benefit corporations”)	

Consumer view towards sustainable choices	
Presence of several associations that still manage commons and large areas of the territory that still are nor public or private but commons (e.g., "ASUC" and "Regole")	
UNESCO World Heritage Sites (Dolomites and 2 Prehistoric Pile Dwelling), 1 UNESCO Biosphere Reserve (BR Ledro Alps and Judicaria) and 1 Geopark (Adamello Brenta Geopark) with their core objectives aimed at fostering sustainability in education and training as well as sustainable tourism	
A shared cooperative culture (Cooperative Federation and cooperatives) as well as a strong voluntary culture (es. Mountain rescue, Fire departments, communities taking part in local associations)	
TECHNICAL TRENTINO CS local drivers	***Secondary aspect**
Development of tools for energy and water monitoring	
Increasing development of infrastructures for electric cars (es. recharge stations)	
Technologies for renewable energy production, storage, energy efficiency	
Artificial snow production spread and development of new technologies for production up to 4°C	
Management and construction of new water storages	ENVIRONMENTAL
Development of digital infrastructures in mountain areas	ECONOMIC
The presence of 2 research centres in the Province (FEM and FBK) and 1 University (UniTN) with specific competences that can foster innovation for climate change both on models and scenarios as well as observation of data and testing sites for new technologies and innovative research. Those are research partners involved in different projects (local, national, European) that promote a multitude of research advancement and pilot development as well as capacity building.	
The presence of Innovation hubs (HIT, Trentino Sviluppo, Mechatronic Hub) that can help facilitate integration of technologies	
A dynamic territory and various local players willing to participate in European projects, also related to climate change, from various calls and pillars: IPCEI, HORIZON EU, INTERREG, LIFE, etc.	
Manifattura Tabacchi in Rovereto as the Pole of the Green Innovation Factory: sustainable building, renewable energy, environmental technologies, natural resources, circular economy.	
The presence of current sustainable mobility projects (such as Bus&Go, the BRT project, cableways promoted for alternative mobility)	
Contribution to climate change adaptation through the development and research of climate services and early warning systems	
Contribution to climate change mitigation and adaptation through the improvement of energy efficiency and the resilience of energy infrastructures	ENVIRONMENTAL
LEGAL TRENTINO CS local drivers	***Secondary aspect**
Being an Autonomous Province with a wide legislative autonomy in all the most important fields of public government	
Specific laws and Provincial Urban Plans that enforce the conservation areas of Natural parks	
Minimum share of RES (renewable energy support) in new/renovated building	
Single Provincial Authorisation Measure (PAUP) that includes the EIA (Environmental Impact Assessment) measure and the necessary permits for the realization and operation of projects subject to EIA.	
Publication and monitoring of the Provincial Energy and Environmental Plan in 2021	
Publication of the Water Management Plan in 2022	

Update and publication of new Hazard Maps for the Province of Trento	
Ban of plastic in all events financed by the Province	SOCIAL
ENVIRONMENTAL TRENTINO CS local drivers	***Secondary aspect**
Increased water demand and competition for this resource (e.g., for snow production)	
(*also a challenge*) Increase of temperatures that reduce the heating needs (energy consumption reduction) and increase the cooling needs (energy consumption growth). Estimated temperature increase for the city of Trento is about 2°C (1850-2020) and the variation in average monthly temperatures appears to be characterized by significant upward trends (0.03 and 0.05°C per year in the Province)	
Increase of temperatures that encourage residents to move from the cities to the mountain: repopulation of mountain areas	
Urban heat waves drive residents and tourists to temporarily move to higher altitude	
Improving management of territory to face extreme events (intense precipitation, intense winds, etc.)	
Defined conservation and sustainable development objectives due to the presence of a network of natural areas such as 2 Provincial Natural Parks, Natura 2000 sites and 1 National Park (31.4% of the Autonomous Province of Trento is a protected area)	
Contribution to climate change adaptation through the improvement of biodiversity management and ecosystem connectivity	
(*also a challenge*) A significant reduction in both the duration of snow cover and average seasonal snow depth, with different responses to climate change for low and high altitude sites. Strongly marked trends of decreasing snowfalls for the locations on the valley bottoms, whereas snow cover is stable above 2000 m.	
Basins located at higher altitudes, characterized by a strong input from snow and glacier melt, display trends of positive flow change in both summer and winter (due to winter rainfall that increasingly replaces snowfall).	
(*also a challenge*) Basins located at lower or wider altitudes (e.g., the basins of rivers on the valley bottom) show negative flow variations, especially during summer	
(*also a challenge*) Evidence of permafrost degradation	
Contribution to climate change adaptation through the improvement of water use efficiency and water management	
(*also a challenge*) The rate of glacier retreat is accelerating and the surface area of glaciers has shrunk to about a quarter of the last maximum expansion	

11.5. Annex 5. Case Study 3 – Boreal region (Norrbotten): Past experience and legal framework analysis

Table 81. Relevant documents identification of CS3 Västerbotten and Norrbotten Countries Island (those with the first column in green are the ones selected for the deeper analysis)

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
1	**A National Food Strategy for Sweden** – more jobs and sustainable growth throughout the country	Strategy	https://tillvaxtverket.se/download/18.365d74d91841489e3d07e543/1668064341176/en-livsmedelsstrategi-for-sverige-fler-jobb-och-hallbar-tillvaxt-i-hela-landet-prop-2016-17-104%20(2).pdf	National	2017	• Agriculture, forestry and fishing • Society	The overall objective of the food strategy is a competitive food supply chain that increases overall food production while achieving the relevant national environmental objectives, aiming to generate growth and employment and contribute to sustainable development throughout the country.
2	**Prioritised action framework (PAF) for nature 2000 in Sweden**	Guideline	https://www.naturvardsverket.se/contentassets/5781ebad94e34a478aa95b7163234b4a/bilaga-1-paf-en-sweden-2021-09-23.pdf	National	2021 (-2027)	• Biodiversity and natural heritage • Agriculture, forestry and fishing	Aimed at providing a comprehensive overview of the measures that are needed to implement the EU-wide Natura 2000 network and its associated green infrastructure, specifying the financing needs for these measures and linking them to the corresponding EU funding programmes.
3	**National energy and climate plans – Sweden**	Plan	https://www.climate-laws.org/geographies/sweden/policies/sweden-s-integrated-national-energy-and-climate-plan#:~:text=Sweden%E2%80%99s%20Integrated%20National%20Energy%20and%20Climate%20Plan.%20Executive.,Energy%20and%20Climate%20Plan%20addresses%20all%20five%20	National	2020 (-2030)	• Energy	The Integrated Energy and Climate Plan elaborates on Sweden's existing energy and climate goals, policies and measures and on the associated scenarios.
4	**National Forest strategy – Sweden** (Strategi för Sveriges nationella skogsprogram)	Strategy	https://www.regeringen.se/49bad6/contentassets/34817820fe074cb9aeff084815bd3a9f/20180524_hela.pdf	National	2018 (-2030)	• Agriculture, forestry and fishing • Energy • Biodiversity and natural heritage	A participatory, holistic, cross-sectoral and iterative process for policy planning, implementation, monitoring and evaluation at the national and/or regional level.

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
5	**Sweden's strategy plan for agriculture policy 2023–2027**	Strategy	https://www.regeringen.se/4af4aa/contentassets/d5087edd9e184138be1cb46153c0d91c/uppdrag-att-overlamna-forslag-till-sveriges-strategiska-plan-for-den-gemensamma-jordbrukspolitiken-20232027-till-europeiska-kommissionen.pdf	National	2021 (2023 – 2027)	• Agriculture, forestry and fishing • Biodiversity and natural heritage	Proposal for a strategic plan for the implementation of the common agricultural policy.
6	**Handbook for strategic municipal water management**	Guideline	https://www.vattenplanering.se/handbook-for-strategic-municipal-water-management-a-summary/	Sectoral	2018	• Water and waste • Cities and urban planning	The handbook includes the best available knowledge about municipal water management and provides a general description with recommendations for how a municipality can work with water issues.
7	**Action plan to increase production, consumption and export of organic food**	Plan	https://www2.jordbruksverket.se/download/18.6412fcaf162e485c3c1b4ecf/1524546625771/ra18_16.pdf	National	2018 (-2030)	• Agriculture, forestry and fishing • Biodiversity and natural heritage	An action plan to promote the government's goals of 30 percent organic agricultural land and 60 percent public consumption by 2030.
8	**Action plan for the development of Swedish aquaculture**	Plan	https://www2.jordbruksverket.se/download/18.645cfb5014d6e8d36ae24789/1496922506984/ra15_1v2.pdf	National	2012 (-2020)	• Agriculture, forestry and fishing	This action plan presents measures that will contribute to achieving the goals and vision in the national aquaculture strategy Swedish aquaculture – a green industry on blue fields, strategy 2012–2020.
9	**Beach protection - a guide for planning and testing. Handbook 2009: 4, Edition 2.**	Guideline	-	Sectoral	2009	• Cities and urban planning • Tourism, cultural heritage	This guidance forms a basis for the application of the beach protection regulations and shall be a support for personnel who handle beach protection issues in connection with plans and exemptions at county boards and municipalities
10	**Nature conservation agreement Guidelines for application**	Guideline	https://www.naturvardsverket.se/contentassets/d9c6609a8513492c963f893fdf11e25e/naturvardsavtal-riktlinjer-2013-06-20.pdf	Sectoral	2013	• Biodiversity and natural heritage • Agriculture, forestry and fishing • Tourism, cultural heritage	The use of nature conservation agreements to protect valuable nature is expected to increase and form a significant part of the work to achieve the environmental quality goals decided by the Riksdag.

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
11	**Sea plans for Gulf of Bothnia, The Baltic Sea and The North Sea**	Plan	https://www.havochvatten.se/download/18.4705beb516f0bcf57ce1b184/1604327609565/forslag-till-havsplaner.pdf	Regional	2019	• Agriculture, forestry and fishing • Transport • Tourism, cultural heritage	Marine plans provide guidance on the most appropriate use of the sea.
12	**Guidance on how outdoor life can be taken into account in action plans for green infrastructure**	Guideline	https://www.naturvardsverket.se/globalassets/vagledning/samhallsplanering/handlingsplaner-gron-infrastruktur/vagledning-friluftsliv-beaktas-handlingsplaner-gron-infrastruktur.pdf	Sectoral	2018	• Tourism, cultural heritage • Biodiversity and natural heritage • Cities and urban planning	The guidance provides proposals for knowledge and planning documents, analyses and measures needed to preserve and develop the conditions for outdoor life, to clarify how outdoor life can be considered in the work with the development of action plans for green infrastructure.
13	**Objectives for outdoor life policy**	Policy	https://data.riksdagen.se/fil/CBAD1962-6F3C-47CB-A26B-CF3DFD241297	Sectoral	2012	• Tourism, cultural heritage • Biodiversity and natural heritage • Cities and urban planning	Goals for the policy of outdoor life are reported and the investments that have been made with the aim of developing these goals are reported. In addition, the government's view on the future work with development and follow-up of the goals for the outdoor life policy is explained.
14	**Proposed national plan for transport system 2018–2029**	Plan	http://trafikverket.diva-portal.org/smash/get/diva2:1363916/FULLTEXT01.pdf	National	2018 (-2029)	• Transport • Cities and urban planning	National plan for the transport system 2018–2029, which includes measures to maintain Sweden's state infrastructure and develop state roads and railways as well as shipping and aviation.
15	**National strategy for the protection of maritime and watercourse environments with high natural and cultural values**	Strategy	https://www.havochvatten.se/download/18.55eea46217e787346e53bac3/1643034996487/Rapport%20202121_21.pdf	National	2022 (-2030)	• Agriculture, forestry and fishing • Tourism, cultural heritage • Biodiversity and natural heritage	This strategy should contribute to better protection of lake and water environments with high natural and cultural values and can be preserved for future generations in accordance with the environmental quality objective Living lakes and watercourses.

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
16	**National strategy for sustainable regional development throughout the country 2021–2030**	Strategy	https://www.regeringen.se/4956ea/contentassets/53af87d3b16b4f5087965691ee5fb922/nationell-strategi-for-hallbar-regional-utveckling-i-hela-landet-20212030	National	2021 (-2030)		The strategy forms the focus of the regional development policy. The implementation of the regional development policy must be coordinated with the rural policy, the policy for sustainable urban development, the environmental policy and other relevant policy areas.
17	**Roadmap for fossil free mining- and mineral industry**	Roadmap	https://fossilfrittsverige.se/wp-content/uploads/2020/09/Fardplan_Gruv-och-mineralbranschen_uppgraderad2022.pdf	Sectoral	2021-	• Mining and quarrying	The roadmap presents how the goal of fossil free mining by 2035 and the goals of climate-neutral processes and fossil-free energy use by 2045.
18	**Regional development strategy Norrbotten 2030**	Strategy	https://utvecklanorrbotten.se/media/aj2km14r/regional-utvecklingsstrategi-norrbotten-2030_webb-utskrift-a4.pdf	Regional	2018 (-2030)	• Transport • Industry and commerce • Society	The overall strategic document for sustainable growth in Norrbotten. Describes the regions desirable development and growth.
19	**Regional plan for climate change adaptation**	Plan	https://www.lansstyrelsen.se/download/18.1651ab04174bf0ffe18a91b/1602077047946/Regional%20handlingsplan%20f%C3%B6r%20anpassning%20till%20f%C3%B6r%C3%A4ndrat%20klimat.pdf	Regional	2020	• Agriculture, forestry and fishing • Mining and quarrying • Energy • Biodiversity and natural heritage • Tourism, cultural heritage	Describes recommended actions for different sectors.
20	**Program for Norrbottens environmental objectives**	Roadmap	https://catalog.lansstyrelsen.se/store/31/resource/296	Regional	2022	• Biodiversity and natural heritage	Aim is to contribute to obtaining environmental objectives and thus a sustainable development in the region.

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
21	**Green infrastructure in Norrbotten – a preliminary action plan**	Plan	https://www.lansstyrelsen.se/norrbotten/om-oss/vara-tjanster/publikationer/visning-av-publikation.html#esc_entry=90&esc_context=31&esc_-org=lss%3Acounty%2FBD	Regional	2018	• Biodiversity and natural heritage • Cities and urban planning • Society	This plan is not binding, but can act as source of information for decision-making regarding land use in connection with infrastructure.
22	**Regional program for environmental monitoring, Norrbotten County 2021-2026**	Plan	https://catalog.lansstyrelsen.se/store/31/resource/DBD_2020_7	Regional	2021 (-2026)	• Biodiversity and natural heritage • Agriculture, forestry and fishing • Water and waste	Regional program for environmental monitoring provides an overview of the state of the county. The results are obtained through environmental monitoring.
23	**Regional Action plan for countryside program and ocean and fishery program 2014-2020, updated 2021**	Plan	https://catalog.lansstyrelsen.se/store/31/resource/154	Regional	2021	• Agriculture, forestry and fishing	Regional plan showing how the County administrative board will act on a regional level. It strengths competitiveness in agriculture and fisheries, promotes sustainable management of natural resources, promotes employment and a balanced territorial development in rural areas.
24	**Norrbotten food strategy 2022-2030**	Strategy	https://www.naramat.nu/wp-content/uploads/220225_ls_norrbotten_nara_maten_ta.pdf	Sectoral	2022 (-2030)	• Agriculture, forestry and fishing • Society • Biodiversity and natural heritage	The strategy contains objectives that are aimed to be reached through a collaboration between the County administrative board, the municipalities in Norrbotten and the Federation of Swedish farmers.
25	**Norrbotten food strategy action plan 2022-2025**	Plan	https://www.naramat.nu/wp-content/uploads/Handlingsplan-tillganglig-na%CC%88ra-mat-2022-2025-2.pdf	Sectoral	2022 (-2025)	• Agriculture, forestry and fishing • Society • Biodiversity and natural heritage	The action plan is directed at producers and consumers throughout the value chain.
26	**Program for conservation areas in Norrbotten county 2012–2016** (still current)	Plan	https://catalog.lansstyrelsen.se/store/31/resource/12_2011	Regional	2012 (still current)	• Agriculture, forestry and fishing • Biodiversity and natural heritage	The program sets the baseline for The County administrative board regarding conservation areas. The program states how for example forest management and water management should be conducted.

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
27	**Regional program for remediation of contaminated sites Norrbotten county 2021-2023**	Plan	https://catalog.lansstyrelsen.se/store/31/resource/243	Regional	2021 (-2023)	• Mining and quarrying • Industry and commerce • Water and waste	Describes the contaminated sites in the county prioritised for monitoring and remediation.
28	**Norrbotten climate and energy strategy 2020–2024**	Strategy	https://docslib.org/doc/265193/climate-and-energy-strategy-for-the-county-of-norrbotten-2020-2024	Regional	2020 (-2024)	• Energy • Society • ICT	Contains the same climate goals as is defined on national level. The strategy is a tool for integrating climate and energy in for example regional development, environmental assessment and urban planning.
29	**Plan regarding infrastructure for electrical vehicles and renewable fuels in Norrboten County**	Plan	https://catalog.lansstyrelsen.se/store/31/resource/DBD_2020_1	Regional	2020	• Energy • Cities and urban planning	The plan contains guidelines and recommendations and can be used as strategic supporting document for supporting and coordinating the development of infrastructure for renewable fuels in Norrbotten Country.
30	**Plan for water shortage and drought 2021 - 2027 for the Bothnian Bay**	Plan	https://www.vattenmyndigheterna.se/download/18.5df150191754f287d9176c6/1630582856669/F%C3%B6rslag%20till%20delf%C3%B6rvaltningsplan%20Bottenviken.pdf	Regional	2021 (-2027)	• Agriculture, forestry and fishing • Water and waste	The aim is to prevent and minimize negative effects of water shortage on the economy, society and environment so that the environmental quality standards for surface water and ground water can be reached.
31	**Strategy for reindeer husbandry by The Sami Parliament**	Strategy	https://www.sametinget.se/156607	Sectoral	2021	• Agriculture, forestry and fishing • Tourism, cultural heritage • Biodiversity and natural heritage	The aim of the strategy for reindeer husbandry is to strengthen and develop reindeer husbandry so it is culturally, socially, economically and environmentally sustainable.
32	**Climate strategy by the Sami Parliament**	Strategy	https://www.sametinget.se/130410	Sectoral	2019	• Agriculture, forestry and fishing • Biodiversity and natural heritage • Tourism, cultural heritage	The climate strategy states the Sami Parliament orientation in the work with climate issues. The strategy should be seen as a political statement at the same time as it constitutes the framework for and guides the Sami Parliament's work with the action plan for climate adaptation.

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
33	**Action plan for climate adaptation by The Sami Parliament**	Plan	https://www.sametinget.se/klimat/handlingsplan	Sectoral	2017 (still current)	• Agriculture, forestry and fishing • Biodiversity and natural heritage • Tourism, cultural heritage	The main target group for the action plan is the Sami community. But the action plan is also aimed at other social stakeholders who can contribute to Sami industries and Sami culture can better face changes that we already see and those that can be expected in the future. The action plan consists of a system of measures that in some cases require cooperation locally, regionally, nationally or internationally, also with other indigenous people.
34	**Regional forestry program for Norrbotten County**	Strategy	https://catalog.lansstyrelsen.se/store/31/resource/222	Sectoral	2020	• Agriculture, forestry and fishing • Biodiversity and natural heritage • Society	The document is pointing out different areas that need intervention and is also meant to be used when experiencing conflicts of interests regarding forestry and land use in the region.
35	**Action plan Connected to The regional forestry program for Norrbotten County**	Plan	https://catalog.lansstyrelsen.se/store/31/resource/222	Sectoral	2020	• Agriculture, forestry and fishing • Biodiversity and natural heritage • Tourism, cultural heritage	The action plan is handled by the steering committee for Norrbotten forestry program. And aims to empower, stimulate and inspire to further activities, actions and further knowledge acquisition.
36	**Future scenarios for tourism in Swedish Lapland**	Other	https://www.swedishlaplandvisitorsboard.com/wp-content/uploads/2022/03/SwLap-Scenariorapport-210623.pdf	Sectoral	2021	• Tourism, cultural heritage	An analysis with subsequent scenario development, where the different futures for the hospitality industry in Swedish Lapland until 2030 are examined and described. The work has resulted in four scenarios, based on the development of two strategic uncertainties.
37	**Smart specialisation in Norrbotten**	Strategy	https://www.norrbotten.se/publika/lg/regio/2020/smart_specialisering_eng_200707_webb.pdf	Regional	2019 (-2030)	• Cities and urban planning • Energy • Industry and commerce	Focuses on how Norrbotten must work according to the smart specialization method and build new industries based on the strengths and knowledge advantages we already have.

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
38	**Public health strategy Norrbotten 2018-2026**	Strategy	https://www.norrbotten.se/publika/lg/utv/Folkh%c3%a4lsocentrum/Folkh%c3%a4lsopolitiska%20	Regional	2018 (-2026)	• Society	The public health strategy has been developed with the primary goal of coordinating the county's resources, contribute to the county working in the same direction and act as support in the work of all concerned organisations towards improved public health.
39	**Svemin Position Document – Indigenous People and Mineral Extraction**	Guideline	https://wwwsveminse.cdn.triggerfish.cloud/uploads/2021/10/svemin_position_urfolk_eng.pdf	Sectoral	2019 (still current)	• Mining and quarrying • Biodiversity and natural heritage • Tourism, cultural heritage	Description on the Samis right to land and Svemins view on Sami rights.

The sections below include detailed analysis of the most relevant documents performed within the Norrbotten Case Study.

11.5.1. Annex 3.1. Deep analysis of document #1 of CS3

Table 82. Document #1 of CS3 Västerbotten and Norrbotten Countries deeply analysed

Case Study	**CS3 – Boreal Region Västerbotten & Norrbotten Countires (SE)**		
#1	**A National Food Strategy for Sweden** – more jobs and sustainable growth throughout the country		
Type of document	Strategy	**Language(s)**	Swedish
Scope	National	**Year of adoption**	2017
Web link	https://tillvaxtverket.se/download/18.365d74d91841489e3d07e543/1668064341176/en-livsmedelsstrategi-for-sverige-fler-jobb-och-hallbar-tillvaxt-i-hela-landet-prop-2016-17-104%20(2).pdf	**Target year**	-
Sectors involved	Agriculture, forestry and fishing	Society	
Main target addressed	The overall objective of the food strategy is a competitive food supply chain that increases overall food production while achieving the relevant national environmental objectives, aiming to generate growth and employment and contribute to sustainable development throughout the country.		
Other relevant objectives or strategies addressed			
O1	Continue to be a leading country in climate.		
O2	Animal health		
O3	Healthy food		
O4	Swedish agriculture can contribute to the global supply.		
Relevant policies and measures included			
P&M1	Develop Swedish foodstuff production so that it contributes to a greater degree to meet the global demand for food with little climate impact. In this way, increased food production in Sweden can cooperate with measures to reduce global emissions of greenhouse gases.		
P&M2	Improve Swedish food production is necessary to be able to reach national climate goals		
P&M3	The design of the rules and conditions must support the objective about a competitive and sustainable food chain where production increases. This is made through appropriate taxes and fees, rule simplifications, administrative relief and other measures to strengthen competitiveness and profitability.		
P&M4	Consumers must have a high level of confidence in the foodstuffs and be able to make conscious and sustainable choices, for example by locally produced and organic. The market for foodstuffs must be characterized by well-functioning competition. Swedish food exports must be given the conditions to increase in order to meet the demand for relevant markets		
P&M5	Support the knowledge and innovation system for to contribute to increased productivity and innovation in the food chain and sustainable production and consumption of food.		
Actuation areas	Food industry		
Additional relevant information	As part of implementing the strategy, the government will take produce an action plan. The action plan will contain measures, which contributes to achieving the goals in the strategy and will be continuously updated.		

11.5.2. Annex 3.2. Deep analysis of document #3 of CS3

Table 83. Document #3 of CS3 Västerbotten and Norrbotten Countries deeply analysed

Case Study	**CS3 – Boreal Region Västerbotten & Norrbotten Countires (SE)**		
#3	**National energy and climate plans – Sweden**		
Type of document	Plan	**Language(s)**	English
Scope	National	**Year of adoption**	2020
Web link	https://www.climate-laws.org/geographies/sweden/policies/sweden-s-integrated-national-energy-and-climate-plan#:~:text=Sweden%E2%80%99s%20Integrated%20National%20Energy%20and%20Climate%20Plan.%20Executive.,Energy%20and%20Climate%20Plan%20addresses%20all%20five%20	**Target year**	2030
Sectors involved	Energy		
Main target addressed	The Integrated Energy and Climate Plan elaborates on Sweden's existing energy and climate goals, policies and measures and on the associated scenarios.		
Relevant policies and measures included			
P&M1	Sweden shall have no net emissions of greenhouse gases to the atmosphere by 2045		
P&M2	Sweden's energy use shall be 50% more efficient by 2030 compared to 2005, expressed in terms of energy supplied in relation to gross domestic product (GDP)		
P&M3	Sweden's electricity production shall be 100 percent renewable by 2040		
P&M4	The target for 2030 is to reduce emissions from the non-EU ETS or LULUCF sectors by 63% compared to their 1990 levels		
P&M5	Reduce emissions to 20% of the 2005 levels by 2030		
P&M6	By 2030 greenhouse gas emissions from national transport, excluding national flights, must be at least 70% lower than they were in 2010		
Actuation areas	National level (Sweden)		
Additional relevant information	-		

11.5.3. Annex 3.3. Deep analysis of document #10 of CS3

Table 84. Document #10 of CS3 Västerbotten and Norrbotten Countries deeply analysed

Case Study	**CS3 – Boreal Region Västerbotten & Norrbotten Countires (SE)**		
#10	**Nature conservation agreement Guidelines for application**		
Type of document	Guideline	**Language(s)**	Swedish
Scope	Sectoral	**Year of adoption**	2013
Web link	https://www.naturvardsverket.se/contentassets/d9c6609a8513492c963f893fdf11e25e/naturvardsavtal-riktlinjer-2013-06-20.pdf	**Target year**	ongoing
Brief description	The use of nature conservation agreements to protect valuable nature is expected to increase and form a significant part of the work to achieve the environmental quality goals decided by the Riksdag. The		

	document contains the Swedish Environmental Protection Agency's and the Swedish Forestry Agency's joint guidelines for working with nature conservation agreements.		
Sectors involved	Biodiversity and natural heritage	Agriculture, forestry and fishing	Tourism, cultural heritage
Main target addressed	The overall aim of the guidelines is that the authorities' management of the process of forming nature conservation agreements is carried out uniformly, so that it does not matter to the property owner which authority signs the agreement. It is important that there is no ambiguity among property owners and others concerned about what a nature conservation agreement entails. The guidelines should be a support for the authorities in their work with signing nature conservation agreements		
Other relevant objectives or strategies addressed			
O1	Care agreement (can be supplementary to nature conservation agreement, and state that the land owner will take care of the land in some specified way, as opposed to the nature conservation agreement, that is an agreement only of what they will not do to the land – e.g., clear cut forest)		
O2	Tourism and recreation		
Relevant policies and measures included			
P&M1	Nature conservation agreements are used so that the authority works together with the property owner to ensure that an area's natural values are preserved and developed in the long term. The main direction and priority for nature conservation agreements is aimed to preserve and develop biological diversity. Cultural environmental values and values for recreation constitute support criteria for the existing biological values.		
P&M2	Nature conservation agreements are a form of protection that should contribute to participation and increased commitment.		
P&M3	Nature conservation agreements are for areas that are prioritized in the work to achieve the environmental quality goals.		
P&M4	The authority that has signed the agreement is responsible for monitoring compliance. The authority follows up that the purpose of the agreement is achieved and that the marking in the field is clear. It is also suitable to e.g., plan for conservation management measures at the time of follow-up in the field. Follow-up and evaluation must be documented in writing and any deficiencies rectified. The evaluation also from the basis for the authority's dialogue with the property owner when the agreement expires. Follow-up of individual nature conservation agreements should normally take place every four years.		
Actuation areas	National level (Sweden)		
Additional relevant information	-		

11.5.4. Annex 3.4. Deep analysis of document #14 of CS3

Table 85. Document #14 of CS3 Västerbotten and Norrbotten Countries deeply analysed

Case Study	**CS3 – Boreal Region Västerbotten & Norrbotten Countires (SE)**		
#14	**Proposed national plan for transport system 2018–2029**		
Type of document	Plan	**Language(s)**	Swedish
Scope	National	**Year of adoption**	2018
Web link	http://trafikverket.diva-portal.org/smash/get/diva2:1363916/FULLTEXT01.pdf	**Target year**	2029
Sectors involved	Transport	Cities, urban planning	
Main target addressed	National plan for the transport system 2018–2029, which includes measures to maintain Sweden's state infrastructure and develop state roads and railways as well as shipping and aviation.		
Other relevant objectives or strategies addressed			

O1	Research and innovation
O2	Education and society
O3	Mobility and Transport
O4	Forestry
O5	Industry and services
O6	Mining industry
O7	Regional development, sustainable economic, ecological and social development of the countryside and region
O8	Human health
O9	Energy efficiency
O10	Electrification of transports
Relevant policies and measures included	
P&M1	Prioritise maintenance of railways, including the 4 most important lines, of which 2 are in Norrbotten county. The aim of the prioritised maintenance is to keep functionality or improve it at the most important lines, and keeping at least basic functionality at others
P&M2	Modernise the railway signalling system, adopting the EU system ERTMS
P&M3	Increase railway capacity, in northern Sweden by building a new line between Umeå and Skellefteå, as well as improving the strength of the most used lines and measures for longer, heavier and larger trains
P&M4	Prioritise maintenance of highly used urban roads, main roads and roads important for public transport and industry, keeping or improving capacity there, while keeping basic functionality for the rest of the roads
P&M5	Increase safety on the roads (by decreased sped limits, cameras, centre rails, alert strips and other measures)
P&M6	Increase and improve bike routes
P&M7	Research and innovation for bike and pedestrian mobility
P&M8	Improve ports and sea routes
P&M9	Financial supports for sustainable mobility in cities and towns
P&M10	Measures to lessen the negative effects of infrastructure and traffic on landscape, biodiversity and natural and cultural environments, such as passages across roads, removal of invasive species, species rich roadsides etc.
P&M11	Noise reducing measures
P&M12	Measures against water pollution caused by traffic and accidents. Prioritise areas important for drinking water and high biological importance
P&M13	Decontamination of areas polluted by transportation activities
P&M14	Information and education on climate mitigation in the transport sector
P&M15	Information and education on traffic safety, including on lowering speed
P&M16	Research and innovation on transformation to a fossil fuel free transport sector
P&M17	Adapt the railway system for a changed climate, e.g., by strengthening bridges
P&M18	Develop methods for risk classing of railway structures with regards to climate change effects
P&M19	Measures for increased biking and safer biking
Actuation areas	National level (Sweden). Norrbotten and Västerbotten counties in chapter 11.3

Additional relevant information	The document is titled "proposed plan...", but it is the actual adopted plan.

11.5.5. Annex 3.5. Deep analysis of document #18 of CS3

Table 86. Document #18 of CS3 Västerbotten and Norrbotten Countries deeply analysed

Case Study	**CS3 – Boreal Region Västerbotten & Norrbotten Countires (SE)**		
#18	**Regional development strategy Norrbotten 2030**		
Type of document	Strategy	**Language(s)**	Swedish
Scope	Sectoral	**Year of adoption**	2018
Web link	https://utvecklanorrbotten.se/media/aj2km14r/regional-utvecklingsstrategi-norrbotten-2030_webb-utskrift-a4.pdf	**Target year**	2030
Brief description	The overall strategic document for sustainable growth in Norrbotten. Describes the regions desirable development and growth.		
Sectors involved	Transport	Industry and commerce	Society
Main target addressed	To become Sweden's most welcoming and innovative county		
Other relevant objectives or strategies addressed			
O1	Build at least 1,500 homes per year		
Relevant policies and measures included			
P&M1	The proportion of people traveling by public transport must increase 25% by 2030		
P&M2	Proportion of the population that reaches a central location within 60 minutes by car or public transport must increase		
P&M3	The proportion of goods loaded/unloaded by truck must decrease and be transferred to rail and shipping		
P&M4	No net emissions of greenhouse gases in 2045 (max 15% left can be handled via compensatory measures).		
P&M5	Greenhouse gas emissions from domestic transport must be reduced with at least 70% by 2030 at the latest (compared to 2010)		
P&M6	50% more efficient energy use in 2030 (added energy/BRP-SEK)		
P&M7	100 % renewable electricity production 2040		
Actuation areas	Generally applicable to the whole case study territory.		
Additional relevant information	-		

11.5.6. Annex 3.6. Deep analysis of document #19 of CS3

Table 87. Document #19 of CS3 Västerbotten and Norrbotten Countries deeply analysed

Case Study	**CS3 – Boreal Region Västerbotten & Norrbotten Countires (SE)**		
#19	**Regional plan for climate change adaptation**		
Type of document	Plan	**Language(s)**	Swedish
Scope	Regional	**Year of adoption**	2020

Web link	https://www.lansstyrelsen.se/download/18.1651ab04174bf0ffe18a91b/1602077047946/Regional%20handlingsplan%20f%C3%B6r%20anpassning%20till%20f%C3%B6r%C3%A4ndrat%20klimat.pdf	**Target year**	-
Brief description	Describes recommended actions for different sectors.		
Sectors involved	Agriculture, forestry and fishing	Mining and quarrying	Energy
	Biodiversity and natural heritage	Tourism, cultural heritage	
Main target addressed	Targets addressed: health aspects, communications, railways, technical infrastructure (dams), mining dams, technical distribution systems, drinking water, sewage water, buildings, forestry, agriculture, aquaculture, reindeer husbandry, tourism and outdoor life, tourism and outdoor life.		
Main target addressed (#1)	**HEALTH ASPECTS**		
Other relevant objectives or strategies addressed			
O1	Risk of extreme heat waves affects urban planning and the design of buildings		
O2	Plan for food handling that is adapted to conditions where higher temperatures are more common		
O3	More efficient purification of drinking water		
O4	Ensure access to clean water to hospitals and healthcare facilities		
O5	Establish strategies to support vulnerable groups		
Relevant policies and measures included			
Main target addressed (#2)	**COMMUNICATIONS**		
P&M1	General preventive measures: Erosion protection, landslide/avalanche warning system, gauges for monitoring the presence of frost, load-bearing capacity restrictions, anti-roll bars efforts, enhanced resources for snow management, flood protection through larger discharge capacity in road culverts, frequent and increased supervision of drainage facilities. Consideration of slide and landslide risks when dimensioning and execution of road constructions.		
P&M2	At important junctions for communication, adaptations or actions for managing climate effects is prioritized.		
P&M3	Mapping of conditions, risk inventory: Identification of areas with risk for erosion, landslides and floods through inventories of ditches, drains and repairs of culverts.		
P&M4	Inspection and survey to manage risks of wash-off as a result of high flows.		
P&M5	Foundation reinforcement and installation of a landslide warning system to reduce landslide risks along Malmbanan.		
P&M6	Cord clearance readiness.		
P&M7	Snow trenching and culvert opening.		
P&M8	Cutting down vegetation at the railway tracks are carried out to reduce the risks of tree and leaf fall on the tracks.		
Main target addressed (#3)	**TECHNICAL INFRASTRUCTURES**		
P&M9	Norrbotten County Administration: In the case of mining dams, the future adaptation work should be focused on clarifying risk areas for ongoing and discontinued operations. There are reasons to continuously increase awareness in the area in order to partly be able to cooperate with relevant actors in an efficient manner, partly to be able to take supervisory measures where future climate conditions are taken into account. When dealing with permits and supervising considerations must be made regarding climate effects and climate adaptation. Support to and follow-up by regional sector authorities		

Main target addressed (#4)	TECHNICAL DISTRUBUTION SYSTEMS
P&M10	Municipalities: Where there is need the microbiological safety in the preparation of drinking water should be expanded by being supplemented with purification methods for the separation of viruses and parasites
P&M11	It may be necessary to take measures to cope changes in the chemical/biological quality of the raw water, for example to counteract presence of humus and algae.
P&M12	New water protection areas should be made and existing should be updated. It is recommended that municipalities which do not have a reserve water source to obtain one.
P&M13	County Administrative board: Physical Planning. Cooperation with municipalities, regional and national actors for information and knowledge-raising efforts.
P&M14	Municipalities: In order to secure the sewage system, it is important to already today consider climate change in renewal and action planning, as well as in planning of new areas. Important that sewage management comes in at an early stage in the planning process.
P&M15	Municipalities: Requirements for elevation of ground and maximum permitted level for water and sewage should be determined based on the precautionary principle.
P&M16	Municipalities: The dimensioning recommendations that exist regarding climate-influenced future precipitation and unloading capacity needs to be followed.
P&M17	Municipalities: When planning new areas, it is important to consider future climatic and geological conditions and the long-term usability of the land for development.
P&M18	It is important that the municipalities identify existing buildings that are within areas at risk of flooding, landslides, landslides and erosion and what measures to take which can and need to be taken in different areas.
P&M19	Within risk areas with buildings municipality and property owners should implement measures for preparedness and adaptation to avoid damage.
Main target addressed (#5)	**FORESTRY**
P&M20	The Swedish Forestry Agency has identified both positive and negative effects of climate change. An important effort is to carry out educational/information efforts to increase knowledge about adaptation of forestry to a changed climate.
P&M21	Adaptation of game strains
P&M22	Tree species composition
P&M23	Care for increased storm resistance
P&M24	Biological control of root rot
P&M25	Developed soil preparation and protective trenching to avoid negative impacts on watercourses and ecosystems
P&M26	Developed road maintenance
P&M27	Consideration when it comes to reindeer husbandry, biological diversity, ancient and cultural relics and social values
P&M28	It is also important to support research and results regarding climate adaptation applicable to the northern regions of Sweden.
Main target addressed (#6)	**AGRICULTURE**
P&M29	The County Administrative Board: The efforts made now must be able to cope with the future water load. The plants have a very long life span and it is costly and time-consuming to subsequently change such an integrated and comprehensive system like the waterways in the agricultural landscape. It is important to identify problem areas and, where possible, take preventive measures. By increasing knowledge, essential areas of effort can be identified, where information coordination, recommendations and decision-making material become

	consequential components of the adaptation work. In this work, the County Administrative Board can contribute with efforts. There is a need for more knowledge about how biological production conditions affected by climate change. Climate research with a focus on soil, forest, garden and the rural environment must clearly take place in collaboration with the industries.
Main target addressed (#7)	**REINDEER HUSBANDRY**
P&M30	Restore and care for the watercourses which form spawning habitats for salmon, sea trout and other migratory fish.
P&M31	New installation or improvement of playgrounds is a very important feature, as is eliminating wandering barriers.
P&M32	The planning should be seen in one long time perspective where also expected conditions in 50–100 years are taken into account.
P&M33	Information and education aimed at both active fishermen as other parties, stakeholders and the general public provide increased understanding and better conditions for successful adaptations.
P&M34	The reindeer husbandry has a special position among the terrestrial industries in that areas which is of national interest for the reindeer industry must be protected
P&M35	Important areas that may have status as national interests are migration routes, overnight baits, natural gathering places, difficult passages, special grazing areas, areas around facilities. This requires adaptation from several actors, including: tourism, forestry and wind power.
P&M36	When planning infrastructure, consideration should be given to reindeer husbandry may need alternative migration routes in the event of a changing climate. It is also important to map any differences in the various parts of the county regarding the vulnerability of reindeer husbandry. The different conditions in Norrbotten county when it comes to the natural environment, biological diversity and consequently also ecosystem services, need to be considered.
P&M37	Information efforts and dialogue creation are urgently needed and, as a consequence: design of recommendations and strategies. Furthermore, it is essential to support the Sami Parliament in their climate adaptation activities.
Main target addressed (#8)	**TOURISM AND OUTDOOR LIFE**
P&M38	Create strategies and long-term planning to deal with negative effects of changing visitor and usage patterns in terms of tourism, outdoor recreation, hunting and recreational fishing.
P&M39	Pay attention to effects that may mean reduced attractiveness, e.g., environmental impact and impaired water quality.
P&M40	Create and maintain good quality wildlife and environmental monitoring in order to time record changes.
P&M41	Increase the opportunities for habitat types and wildlife to survive and adapt their distribution in a changing climate through spatial planning of management measures and wildlife management.
P&M42	Ski resorts may need to carry out technical adaptation measures such as: excavation and felling, movement of pistes to north and higher altitudes, manufacture of snow.
P&M43	Develop alternatives to the primary reason for travelling if climate and climate change weather situations prevent the implementation of activities.
P&M44	Information campaigns on the effects, threats, opportunities that have changed climate entails, on the one hand, the measures and strategies necessary to ensure the competitiveness and development power of the industry.
Actuation areas	Generally applicable to the whole case study territory.
Additional relevant information	This is called an action plan but can rather be considered as recommendations to for example municipalities and other organisations.

11.5.7. Annex 3.7. Deep analysis of document #23 of CS3

Table 88. Document #23 of CS3 Västerbotten and Norrbotten Countries deeply analysed

Case Study	**CS3 – Boreal Region Västerbotten & Norrbotten Countires (SE)**		
#23	**Regional Action plan for countryside program and ocean and fishery program 2014-2020, updated 2021**		
Type of document	Plan	**Language(s)**	Swedish
Scope	Regional	**Year of adoption**	2021
Web link	https://catalog.lansstyrelsen.se/store/31/resource/154	**Target year**	ongoing
Brief description	The rural program and the marine and fisheries program aim to contribute, together with other structural fund programmes, to the objectives of the Europe 2020 strategy and smart and sustainable growth for all. The overall objectives of the rural program and the marine and fisheries program are to strengthen competitiveness in agriculture and fisheries, to promote sustainable management of natural resources, to promote employment and a balanced territorial development in rural areas. This document is the regional downscaling of the national programs.		
Sectors involved	Agriculture, forestry and fishing		
Main target addressed	Strengthen competitiveness in agriculture and fisheries, promote sustainable management of natural resources, promote employment and a balanced territorial development in rural areas.		
Other relevant objectives or strategies addressed			
O1	Equality		
O2	Forestry, reindeer husbandry, agriculture, horticulture		
O3	Fisheries		
O4	Industry and services		
O5	Regional development, sustainable economic, ecological and social development of the countryside		
O6	Education and society		
O7	Regional and national increased self-sufficiency with regards to food		
Relevant policies and measures included			
P&M1	Education and advice on environment and climate, with the aim of restoring, preserving and improving biodiversity and the character of the landscape, improving water management, including the management of fertilizers and pesticides, preventing soil erosion and improving soil management, making energy use more efficient within agriculture and food processing and reduce agricultural emissions of greenhouse gases and ammonia.		
P&M2	Education and financial support on restauration of the cultural heritage, including buildings and old agricultural landscapes		
P&M3	Guidance on management of soil and waters in areas with acid sulphate soils		
P&M4	Protection, restoration and management of ecologically valuable grazing lands and meadows		
P&M5	Education and advice on fertiliser use for agricultural crops, for minimising leaching of nutrients, prioritising farms with high potential environmental impact		
P&M6	Education and advice on energy efficiency for farmers		
P&M7	Education and advice on ecological farming		
P&M8	Investment supports aimed at local businesses to counteract decreasing farming, reindeer husbandry and horticulture with accompanying biodiversity loss		
P&M9	Investment supports for energy efficiency and energy crops		

P&M10	Investment supports for activities decreasing emission of greenhouse gases and ammonia in agricultural businesses
P&M11	Financial support for fences against predators
P&M12	Financial support for clearing of grazing land
P&M13	Financial support for measures for improved surface water quality
P&M14	Financial support for construction and reconstruction of wetlands and dams for biodiversity
P&M15	Financial support for construction and reconstruction of wetlands and dams for improved water quality
P&M16	Financial support for rebuilding ditches to create two levels: a deeper channel and banks that can be flooded at high flow
P&M17	Investment supports for biogas production from manure
P&M18	Financial support for developing or restoring natural or cultural values
P&M19	Financial support for developing cooperation and networks between actors
Actuation areas	Norrbotten County
Additional relevant information	-

11.5.8. Annex 3.8. Deep analysis of document #25 of CS3

Table 89. Document #25 of CS3 Västerbotten and Norrbotten Countries deeply analysed

Case Study	**CS3 – Boreal Region Västerbotten & Norrbotten Countires (SE)**		
#25	**Norrbotten food strategy action plan 2022-2025**		
Type of document	Plan	**Language(s)**	Swedish
Scope	Sectoral	**Year of adoption**	2022
Web link	https://www.naramat.nu/wp-content/uploads/Handlingsplan-tillganglig-na%CC%88ra-mat-2022-2025-2.pdf	**Target year**	2025
Brief description	The action plan is directed at producers and consumers throughout the value chain.		
Sectors involved	Agriculture, forestry and fishing	Society	Biodiversity and natural heritage
Main target addressed	More locally produced food.		
Other relevant objectives or strategies addressed			
O1	Increased profitability of Norbothnian food.		
O2	A developed and attractive Norrbothnian food market		
O3	The production of Norrbothnian food has a greater part in society's development and planning		
O4	More companies that contribute to Norbothnian food		
O5	Increased knowledge with consumers within the county about sustainable food and modern farming		
O6	Improve public health at the county's consumers through increased knowledge if sustainable consumption of food and modern farming		
O7	The share of Norrothnian and Swedish food has increased		

O8	The municipalities have development plans for the use of land and water for food production and goal of strengthen the prerequisites for food production businesses.
O9	Reduced food waste
Relevant policies and measures included	
Main target addressed (#1)	**Increased food security in Norrbotten, with production that is resistant to risks**
P&M1	Public organizations develop its operations with special consideration for socially important activities that also include the food sector's activities.
P&M2	Develop contingency plans at regional and municipal level, where the food supply and organisations in the food supply chain have a clear role.
P&M3	Analyse if public procurement can be used as a tool in strategic and long-term work with food security. The design of public procurement of food can be important.
P&M4	Carry out development projects with focus on emergency water with the objective of securing access to clean water in the event of social disturbances.
P&M5	Carry out a strategic analysis to assess the size of production and which foods are needed in state of emergency.
P&M6	Active collaboration to enable conditions for increased competitiveness in the food sector and establishment of more primary producers in the county.
P&M7	Activities to develop and secure sustainable transport and ensure ability to deliver food in the event of social disruptions.
P&M8	Through national and regional collaborations develop preparedness across the northern county borders, also with the objective of increasing the security of supply of food and water in northern Sweden.
P&M9	Develop the cooperation between the county actors and voluntary organisations.
Main target addressed (#2)	**Developed risk- and vulnerability analyses**
P&M10	The regional risk and vulnerability analysis that is updated regularly should stress food production in a clear way to develop the sector's conditions to secure the availability of good food and clean water to the county's residents.
P&M11	Risk and vulnerability analyses must be made in all municipalities where food production is included as a socially important activity for to enable measures aimed at a secure food supply.
P&M12	Activities aimed at food-producing companies (primary production and processing) to strengthen the competence in risk analysis and risk management in which everyone participates the company is made clear. This can result in risk management plan at company level.
P&M13	Carry out feasibility studies where risks mapped and analysed in primary production
P&M14	Development of farm level action plans which aggregated to regional level. Corresponding work can then be done throughout the food chain.
Main target addressed (#3)	**Activities regarding climate adaptation in the food chain**
P&M15	The county's actors and primary production centres must carry out an analysis of opportunities in a changing climate for crop cultivation, as well as identify which one's knowledge that needs to be acquired in one early stage to take part in the development.
P&M16	Activities to identify actions and enable management of climate change and its consequences but also an increased risk of the spread of infection in crops and animals.
P&M17	Regional development actors assess the possibility of designing water strategy for Norrbottens agriculture and gardening in the future changed climate and with increased occurrences of extreme weather. Water quality must also be included.

P&M18	Research and development must take place with the objective of increasing the knowledge of current nature geographical conditions but also future climate conditions for primary production of food in Northern Sweden.
Main target addressed (#4)	**Green transition reduces the use of fossil energy and increases energy efficiency**
P&M19	Develop alternative inputs for food production, for example plant nutrition, fuel and packaging material.
P&M20	Recover waste heat from, for example industry or data centres to turn turnover into food production.
P&M21	Encourage companies in food production and food processing to develop high productivity where inputs are used in a responsible manner and contribute to good environmental performance and high climate efficiency.
P&M22	Business-oriented activities regarding opportunities to develop higher climate effectiveness/environmental effectiveness where also better financial results synchronizes as well as productivity developing activities with high resource efficiency.
P&M23	Inspire primary producers and food processing companies to a green transition in production. The can apply to energy efficiency through energy mapping or by introducing green alternatives as substitutes fossil energy (e.g., biogas, solar cells, bio-based fuels or other inputs.
Actuation areas	Norrbotten County
Additional relevant information	-

11.5.9. Annex 3.9. Deep analysis of document #26 of CS3

Table 90. Document #26 of CS3 Västerbotten and Norrbotten Countries deeply analysed

Case Study	**CS3 – Boreal Region Västerbotten & Norrbotten Countires (SE)**		
#26	**Program for conservation areas in Norrbotten county 2012–2016**		
Type of document	Plan	**Language(s)**	Swedish
Scope	Regional	**Year of adoption**	2012
Web link	https://catalog.lansstyrelsen.se/store/31/resource/12_2011	**Target year**	Still current
Brief description	The program sets the baseline for The County administrative board regarding conservation areas. The program states how for example forest management and water management should be conducted.		
Sectors involved	Agriculture, forestry and fishing	Biodiversity and natural heritage	
Main target addressed	Tourism, including safety along trails and accessibility		
Other relevant objectives or strategies addressed			
O1	Sustainable tourism, including safety along trails and accessibility		
O2	Local participation		
O3	Human health		
O4	Information and education		
Relevant policies and measures included			
P&M1	Classify reserves according to use for tourism, with the aim of assessing need for management, resources, improved accessibility.		
P&M2	Conservation management in nature reserves, where needed to preserve or improve the protected ecosystem or species. Management is done according to conservation plans for the reserves and can consist of burning, fencing,		

	removal of invasive species, restoration of streams, removal of dams and ditches, reintroduction of lost species, mowing and grazing etc.
Actuation areas	Norrbotten County
Additional relevant information	-

11.5.10. Annex 3.10. Deep analysis of document #28 of CS3

Table 91. Document #28 of CS3 Västerbotten and Norrbotten Countries deeply analysed

Case Study	**CS3 – Boreal Region Västerbotten & Norrbotten Countires (SE)**		
#28	**Norrbotten climate and energy strategy 2020–2024**		
Type of document	Strategy	**Language(s)**	English
Scope	Regional	**Year of adoption**	2020
Web link	https://docslib.org/doc/265193/climate-and-energy-strategy-for-the-county-of-norrbotten-2020-2024	**Target year**	2024
Brief description	Contains the same climate goals as is defined on national level. The strategy is a tool for integrating climate and energy in for example regional development, environmental assessment and urban planning.		
Sectors involved	Energy	Society	ICT
Main target addressed	The strategy primarily aims at an energy transition with an increased share of renewable energy and a reduction in energy use.		
Relevant policies and measures included			
Main target addressed (#1)	**FOSSIL-FREE TRANSPORT**		
P&M1	To promote the use and development of coordinated transport in order to streamline the overall need for transport.		
P&M2	To work to create nodes for mixed loading, intermodality and community service.		
P&M3	To promote the development of fossil-free fuels from regional residue resources		
P&M4	To promote the use of fossil fuel for aviation.		
P&M5	To promote investment in railway infrastructure, e.g., Norrbotniabanan		
P&M6	To promote the opportunities for shipping to operate as an attractive means of transport		
P&M7	To promote investment in pedestrian, bicycle and public transport.		
P&M8	To create a countywide infrastructure for renewable fuels and charging points.		
Main target addressed (#2)	**WORLD CLASS PRODUCTION**		
P&M9	To work to highlight Norrbotten as a demonstrator of innovations and new technologies.		
P&M10	To promote the establishment of energy-intensive industry in the county.		
P&M11	To promote increased circular thinking in terms of raw materials and resources.		
P&M12	To support the work to phase out fossil energy use in industry		
P&M13	To support increased regional production of bio-based fuels and products from forestry and agriculture		

Main target addressed (#3)	**FUTURE CONSUMPTION AND TRADE**
P&M14	To work with communication and labelling in order to help consumers make sustainable choices.
P&M15	To increase the use of public procurement as a driving force for the development of sustainable and preferably locally sourced products and services.
P&M16	To act to facilitate the establishment of companies and activities that contribute to increasing the level of self-sufficiency and sustainability in society.
P&M17	To promote the development of circular products, services and business models
Main target addressed (#4)	**RESOURCE-EFFICIENT CONSTRUCTION**
P&M18	To utilise comprehensive planning in order to localise essential societal interests so that energy requirements and greenhouse gas emissions are minimised.
P&M19	To utilise sustainable regional and local building materials to a greater extent.
P&M20	To work with life-cycle perspectives and recycling to a greater extent
P&M21	To work for the labelling and certification of both buildings as well as building materials
Main target addressed (#5)	**FLEXIBLE AND ROBUST ENERGY SYSTEM**
P&M22	To work to optimise energy quality in relation to use.
P&M23	To promote the development of smart systems in order to control energy use in buildings as well as in the transport system and industry.
P&M24	To develop methods and tools to highlight the consumption of energy and the effects of different choices, such as emissions and origin.
P&M25	To work to facilitate the establishment of production plants for renewable energy.
Actuation areas	Regional level
Additional relevant information	-

11.5.11. Annex 3.11. Deep analysis of document #30 of CS3

Table 92. Document #30 of CS3 Västerbotten and Norrbotten Countries deeply analysed

Case Study	**CS3 – Boreal Region Västerbotten & Norrbotten Countires (SE)**		
#30	**Plan for water shortage and drought 2021 - 2027 for the Bothnian Bay**		
Type of document	Plan	**Language(s)**	Swedish
Scope	Regional	**Year of adoption**	2021
Web link	https://www.vattenmyndigheterna.se/download/18.5df150191754f287d9176c6/1630582856669/F%C3%B6rslag%20till%20delf%C3%B6rvaltningsplan%20Bottenviken.pdf	**Target year**	2027
Brief description	The area has no lack of water resources today. A changing climate might affect water quality rather than water availability. The strategies in the document therefor aim to protect water quality and quantity of good quality drinking water, as well as increase knowledge.		
Sectors involved	Agriculture, forestry and fishing	Water and waste	

Main target addressed	The aim is to prevent and minimize negative effects of water shortage on the economy, society and environment so that the environmental quality standards for surface water and ground water can be reached.
Other relevant objectives or strategies addressed	
O1	Research and innovation
Relevant policies and measures included	
P&M1	Increased monitoring for better local and regional data of water quantities and use, risk classification and description of irreversible effects of over use
P&M2	Further development of the information service "vattenbrist", showing regions with risk for lack of drinking water (https://www.smhi.se/vader/varningar-och-brandrisk/varningar-och-meddelanden/vattenbrist)
P&M3	Guidance on water use efficiency, aimed at companies and agriculture
P&M4	Education for regional authorities on permits for water use by large users
P&M5	Develop a plan for re-examination of permits for water use, especially focusing on areas with higher risk for water scarcity
P&M6	Develop wetland strategies for the counties, with the aim of keeping more water in the landscape, with longer residence times.
P&M7	Identify and remove soil drainage structures that are no longer needed, in order to increase the water holding capacity of the landscape
P&M8	Develop the knowledge base to minimize water quality issues due to acid sulphate soil
Actuation areas	The Swedish part of the catchment of Bothnian Bay, which is Norrbotten and part of Västerbotten.
Additional relevant information	-

11.5.12. Annex 3.12. Deep analysis of document #33 of CS3

Table 93. Document #33 of CS3 Västerbotten and Norrbotten Countries deeply analysed

Case Study	**CS3 – Boreal Region Västerbotten & Norrbotten Countires (SE)**		
#33	**Action plan for climate adaptation by The Sami Parliament**		
Type of document	Plan	**Language(s)**	
Scope	Sectoral	**Year of adoption**	2017
Web link	https://www.sametinget.se/klimat/handlingsplan	**Target year**	Still current
Sectors involved	Agriculture, forestry and fishery	Biodiversity and natural heritage	Tourism, cultural heritage
Main target addressed	The main target group for the action plan is the Sami community. But the action plan is also aimed at other social stakeholders who can contribute to Sami industries and Sami culture can better face changes that we already see and those that can be expected in the future. The action plan consists of a system of measures that in some cases require cooperation locally, regionally, nationally or internationally, also with other indigenous people.		
Relevant policies and measures included			
Main target addressed (#1)	**Increased flexibility:** The flexibility is most often described as access to varied pasture for the reindeer and the possibility to adapt pasture according to prevailing conditions weather and needs. But it can be about a flexibility that allows families or individuals to make a living from other Sami industries in parallel with reindeer herding, to increase stability and security in the supply.		

P&M1	Action plans for climate adaptation has to be made by each Sami village, including risk and vulnerability analysis. The investigations should be linked to an investment grant that can be applied for to implement actual measures. The estimated cost of this measure is approx. 10 million SEK for investigations and kroner 30 million SEK implement meaningful measures
P&M2	The Sami villages and concerned county administrative boards should have resources to create action programs to reduce the negative impact from those already carried out exploitations other than from road and rail.
P&M3	Act so that the Swedish Transport Administration receives a task to, in cooperation with the Sami villages and after consultation with the Sami Parliament to develop action programs to reduce the negative impact on reindeer herding existing road and rail networks.
P&M4	Innovations and tests for better pastures: To continue to support innovations and experiments, for example restoration and making pastures available for increased flexibility. It could be the use of new technology such as drones or experiments with the spread of ground lava. The innovations should take place in connection with the work and development of the clean-use plans. With a support of approx. SEK 50,000 per year for each Sámi village, a measure like this would cost about SEK 2.5 million annually.
P&M5	Flexible date zone - Investigate the possibilities and consequences of changing the regulations around the date zone below the cultivation and patchland border, so that reindeer can stay longer on the pasture at needs. This measure requires a smaller effort and is considered part of the Sami Parliament's current one Operation. The measure should therefore not entail any additional cost or need for average.
P&M6	New environmental policy - Investigating the conditions for an economic policy instrument that focuses on reindeer, and thus the importance of reindeer husbandry in maintaining the grazing character of the mountain area. In the investigation should include a review of the control effect of today's current support and allowances and an analysis of it overall incentive structure for reindeer herders to manage the reindeer herd over time. It will naturally form part of the task of investigating the socio-economic consequences of alternative forms of compensation or support. Any future support may, depending on design, have a significant impact on reindeer husbandry and thus the ecosystem services that reindeer herding maintains in the mountain environment. The cost is estimated at SEK 500,000 per year including an implementation period of one year.
P&M7	Business development - To actively support a broadening and deepening of Sami business activities such as hunting, fishing, tourism, duodji (Sámi handicraft) and Sámi farming and work for increased profitability in them Sami industries.
P&M8	Consultation support: Work for support for consultation for the Sami industries and the Sami culture. As for example, forest and encroachment issues take up a lot of time for the Sami villages. This is expected to increase with a continued expansion of wind power. An estimated 25-50% of a full-time position is required in the current situation of each Sami village to monitor their interests in various consultations. The Sámi Parliament should be given tasks and resources to establish support for Sámi villages and Sámi actors who work in different ways on issues to protect the Sami landscape.
Main target addressed (#2)	**Increased knowledge**
P&M9	To ensure that the Sami the knowledge and environmental views are conveyed on, for example, consultation with the authorities is further needed at least one full-time employee at the Sámi Parliament. This resource could also work with questions regarding climate adaptation. The cost of this action has been estimated at between SEK 750,000 and SEK 1 million as the position would require a lot of travel.
P&M10	Increase cooperation with the Swedish Forestry Agency and support consultation between the reindeer husbandry and the forestry industry's key actors to increase understanding of each other's industries and create the conditions for jointly developing a forestry adapted to reindeer husbandry.
P&M11	External communication – climate: Create a forum on Sami initiative that can become an annual meeting place to convey them Sami expert knowledge, e.g., an annual sustainability conference, which gathers various prominent actors and becomes a meeting place and a discussion forum for Sami and other actors in society for e.g., climate adaptation issues.
P&M12	Internal communication - climate Arrange annual training in climate adaptation for all affected Sami. A suitable one The organizer for this would be the Sami Parliament, which then presents one once a year training opportunity with the theme of climate adaptation.
P&M13	Continue to support and develop the Sami villages' work with reindeer herding plans.

Main target addressed (#3)	**Energy preparedness**
P&M14	Set up disaster damage protection - Ensure that the Sami Parliament has a special grant for disaster damage protection to cope unforeseen events such as closed grazing and the need for supplemental feeding. According to earlier experience, the Sami Parliament has seen that a financial buffer of between 10-15 million SEK is required per year to deal with unforeseen events.
P&M15	Investigate the conditions for creating a climate fund. How would such a fund be financed and function and for what purposes? An investigation by an external consultant is recommended to proceed to the bottom of how a climate fund could be designed and function. The cost of one such an investigation has been estimated at around SEK 300,000.
P&M16	Increased cooperation and research on reindeer diseases Continued cooperation with research and institutions such as the Swedish Veterinary Medical Institute (SVA).
Actuation areas	Every place in Norrbotten county where the reindeer husbandry and adjacent business is active.
Additional relevant information	The action plan should be seen as a basis for the Sami Parliament's continued work with climate adaptation and must be considered a document in progress. Time horizon for the implementation of the measures In this action plan, measures are proposed where the time horizon for implementation may vary. Most of the measures can, subject to resources, be started in 2017 and should run for a long time ahead. The implementation of measures related to Innovations and experiments for better pasture has a long time horizon while, for example, producing Action Plans and for climate adaptation for the Sami villages can be implemented in the near future. The Sámi Parliament works based on one holistic perspective and sees that the proposed measures for climate adaptation synchronize with our work on the environmental quality goals, the strategic plan for biodiversity (the so-called the Aichi Goals) in 2020 and Agenda 2030.

11.5.13. Annex 3.13. Deep analysis of document #35 of CS3

Table 94. Document #35 of CS3 Västerbotten and Norrbotten Countries deeply analysed

Case Study	**CS3 – Boreal Region Västerbotten & Norrbotten Countires (SE)**		
#35	**Action plan Connected to The regional forestry program for Norrbotten County**		
Type of document	Plan	**Language(s)**	Swedish
Scope	Sectoral	**Year of adoption**	2020
Web link	https://catalog.lansstyrelsen.se/store/31/resource/222	**Target year**	2021 – 2023
Brief description	The action plan is handled by the steering committee for Norrbotten forestry program. And aims to empower, stimulate and inspire to further activities, actions and further knowledge acquisition.		
Sectors involved	Agriculture, forestry and fishing	Biodiversity and natural heritage	Tourism, cultural heritage
Main target addressed (#1)	**A sustainable forestry with increased climate benefit.**		
Other relevant objectives or strategies addressed			
O1	Equality		
O2	Natural heritage, biodiversity and protected areas		
O3	Forestry		
O4	Cultural heritage		
O5	Industry and services		
O6	Tourism		

O7	Research and innovation
O8	Education and society
O9	Peace, security and social cohesion
O10	Mobility and Transport
Relevant policies and measures included	
P&M1	Investigate how the demand for forest raw materials will be affected by the transition to a bio-based social economy
P&M2	Cooperate for increased growth, respecting the cultural heritage and nature in the forest, and find common goals
P&M3	Work to prevent damage to land, trees and ancient and cultural remains, from forestry measures, climate effects, weather-related events and pest damage
P&M4	Work for a more diverse forest landscape with a diversity of cultural environments, functional ecosystems, green infrastructure, preservation of forests with high natural values and restoration of the forest landscape
Main target addressed (#2)	**Innovations and refined forest raw material in world class**
Other relevant objectives or strategies addressed	
O1	Forestry
O2	Industry and services
O3	Research and innovation
O4	Education and society
O5	Mobility and Transport
Relevant policies and measures included	
P&M1	Investigate what conditions need to be created to enable a regional transition to a bio-based social economy
P&M2	Form a working group with the theme of bio-based economy with the aim of identifying opportunities and obstacles for conversion
P&M3	Work for increased timber construction in the county's municipalities
Main target addressed (#3)	**Sustainable use and conservation of the forest as a profile issue in Swedish international cooperation**
Other relevant objectives or strategies addressed	
O1	Forestry
O2	Industry and services
O3	Research and innovation
O4	Education and society
Relevant policies and measures included	
P&M1	Carry out reviews of all forest value chains with Agenda 2030 and the global goals for sustainable development in focus
P&M2	Work for international cooperation regarding sustainable forestry and multiple use in the forest
Main target addressed (#4)	**A knowledge stride forward for sustainable use and conservation of the forest**
Other relevant objectives or strategies addressed	

O1	Forestry
O2	Industry and services
O3	Research and innovation
O4	Education and society
O5	Equality and integration
O6	Tourism
Relevant policies and measures included	
P&M1	Work for increased dialogue around the forest and its valueswith the aim of increasing knowledge and understanding of each other's needs and interests with a focus on bio-based economy
P&M2	Work to ensure that natural and cultural environments of importance for outdoor life and tourism are mapped and valued so that better balances between different interests can be made
P&M3	Integrate climate knowledge and climate adaptation into existing knowledge investments
P&M4	Organize knowledge seminars and dialogue opportunities relating to current forestry issues in the area of sustainable use and conservation of the forest
P&M5	Promote knowledge of circular bio-economy in the county
Actuation areas	Norrbotten County
Additional relevant information	-

11.6. Annex 6. Case Study 3 – Boreal region (Norrbotten): PESTLE results for the local ecosystem drivers' analysis

The Norrbotten Case Study did realize the three PESTLE activities. The first one took place during the physical consortium meeting in Sitia, where the inputs of that can be seen in following Figure 207. In that exercise, the PESTLE was done in a broader way, not only to consider the drivers (as positive things already in place) but thinking also including challenges, which serve as basis for the goal definition in the last exercise from this PESTLE activity.

Figure 207. Norrbotten PESTLE analysis of local ecosystem drivers (activity during Sitia project meeting)

Then, a contrast exercise was performed by the Local Council of Stakeholders, from which the following outcomes were obtained (Table 95).

Table 95. Norrbotten PESTLE analysis of local ecosystem drivers – input from Local Council Stakeholders

Norrbotten CS POLITICAL local drivers
Land use
Farming traditionally with more organic use
Urban and regional planning is an important part of the transition to a sustainable society
Locally, political governance and political composition are of great importance for the municipality's ambitions and priorities
Urban planning that promotes the development of climate-adapted infrastructure, Land use policy that protects areas, Policy initiative conducive to development
Urban planning with a focus on sustainability, e.g., establishment of new residential areas Kronan and Hertsöheden. Integrated solutions for stormwater
Norrbotten CS ECONOMIC local drivers
Green employment
Tourism
Small-scale and local production that enables smaller entrepreneurs to stay in Norrbotten, guesses that it is important for the majority to feel support from the municipality/region they operate in, for example through help when starting their own companies, innovation competitions, etc.

Large industrial investments with effective solutions to e.g., energy issues, where competence in the green area needs to be high, which means that Norrbotten is probably quite far ahead in terms of green industry - which in itself is a resource you can try to make use of.
The financial support provided largely governs. This may involve calls for projects or financial contributions. But here, too, political prioritisation of resources is relevant.
Active promotion of local green employment in the region, promotion of local production and industry (e.g., to refine the resources generated in the area), local stakeholders invest in, renewable energy systems, available funding for climate adaptation measures
Major investments in green industrialization, the rest of society needs to keep up
Norrbotten CS SOCIAL local drivers
Civil society and public cooperation
The Nature Conservation Society
Local associations can play an important role, partly by creating community, influencing children and young people and implementing actual measures (e.g., ploughing, picking). **Experiences that when one goes from Enthusiast to "activist" followers are lost.**
If civil society is active, it can push and get the public sector to act. It is essential that demands are made from the environment. Then my opinion is that it is still quite new here in Norrbotten. I would like the commitment to be much higher.
Local organisation that promotes the efficient use of resources by raising awareness among residents, Local public initiatives to decarbonise the transport system
Local public initiatives to lower emissions from the transport system
Norrbotten CS TECHNICAL local drivers
Local actors for innovation and adaptation
Railway can be
E.g., use of drones to a greater extent, both for checks (reduced car transports where we today have very long distances, etc.) and as executors of assignments (reduced energy consumption, etc.).
Digitalisation is something that most people have picked up on and that is important to us up here. But it can be developed.
Local actors focusing on research and innovation on climate change adaptation/mitigation
That there is a technical university in the county, which leads to local actors focusing on research and innovation on adaptation/reduction of climate change
Norrbotten CS LEGAL local drivers
Equality and non-discrimination
Natura2000 and chapter 4 section 6 of the environmental code
Rights to land, hunting and fishing. Conflicts between Sami (ethnic group), reindeer herders (business) and "ordinary" Swedes.
It is neglected and, with the policies being pursued nationally, I have no hope at the moment that things will get better either
Protected areas with specific legal status
Law requiring environmental impact assessments
Protected areas with specific legal status
Legislation requiring environmental impact assessments
Legislation in force on equality and non-discrimination
Norrbotten CS ENVIRONMENTAL local drivers
Project for the protection of protected areas
Forest protection

Longer growing season increases production possibilities of crops/plants etc. Staggered autumn gives the opportunity for a longer field season. A longer season with snow in the spring also gives the opportunity for a longer field season. Higher demands are placed on contractors because different consequences often need to be investigated more broadly in order to take account of climate aspects.
It is closely linked to economics and politics. The environment as an individual driving force is important, but people in general must become better at seeing how the different parts are connected. That political governance, economic prioritization and the state of the environment are so much more interconnected than many realize today.
Projects for the protection / conservation / further development of forests, which can contribute to climate adaptation, improvement of air quality / other side benefits

All in all, a final exercise gathering inputs and collective feedback around the different drivers around each aspect was done, with a prior reflection on the case study vulnerable sectors, challenges and goals to overcome those challenges (Table 96), in order to set the basis for the final brainstorm on local drivers that can facilitate or enable the design and deployment of different policies at the case study.

Table 96. Norrbotten CS analysis of challenges and goals related to CS vulnerable sectors to serve as basis for the PESTLE analysis of local ecosystem drivers

NORRBOTTEN VULNERABLE SECTORS
Agriculture, forestry and fishing
Tourism, leisure and cultural heritage
Biodiversity and natural heritage
Energy
CHALLENGES (mainly related with the vulnerable sectors)
Threat to reindeer husbandry due to land-use change and biodiversity loss
Challenge that demand for increased production of renewable energy at the expense of other interests
Challenge with increased risk of loss of biodiversity
Climate change related risks and impacts for the built environment
Ensuring sustainable forest management
Low agricultural self-sufficiency and dependence on imported goods from other parts of Sweden and other countries that are vulnerable to climate change
Need of upgrading the energy system and allocation of resources for climate adaptation and biodiversity loss
Just green transition – given the impacts of new mining and energy production on local and indigenous communities
GOALS (to overcome the challenges)
Swedish environmental quality objective REDUCED CLIMATE IMPACT. In accordance with the UN Framework Convention on Climate Change, concentrations of greenhouse gases in the atmosphere must be stabilised at a level that will prevent dangerous anthropogenic interference with the climate system. This goal must be achieved in such a way and at such a pace that biological diversity is preserved, food production is assured and other goals of sustainable development are not jeopardised. Sweden, together with other countries, must assume responsibility for achieving this global objective.
Swedish environmental quality objective CLEAN AIR. The air must be clean enough not to represent a risk to human health or to animals, plants or cultural assets.
Swedish environmental quality objective NATURAL ACIDIFICATION ONLY. The acidifying effects of deposition and land use must not exceed the limits that can be tolerated by soil and water. In addition, deposition of acidifying substances must not increase the rate of corrosion of technical materials located in the ground, water main systems, archaeological objects and rock carvings.
Swedish environmental quality objective A NON-TOXIC ENVIRONMENT.

The occurrence of human-made or extracted substances in the environment must not represent a threat to human health or biological diversity. Concentrations of non-naturally occurring substances will be close to zero and their impacts on human health and on ecosystems will be negligible. Concentrations of naturally occurring substances will be close to background levels.
Swedish environmental quality objective A PROTECTIVE OZONE LAYER. The ozone layer must be replenished so as to provide long-term protection against harmful UV radiation.
Swedish environmental quality objective A SAFE RADIATION ENVIRONMENT. Human health and biological diversity must be protected against the harmful effects of radiation.
Swedish environmental quality objective ZERO EUTROPHICATION. Nutrient levels in soil and water must not be such that they adversely affect human health, the conditions for biological diversity or the possibility of varied use of land and water.
Swedish environmental quality objective FLOURISHING LAKES AND STREAMS. Lakes and watercourses must be ecologically sustainable and their variety of habitats must be preserved. Natural productive capacity, biological diversity, cultural heritage assets and the ecological and water-conserving function of the landscape must be preserved, at the same time as recreational assets are safeguarded.
Swedish environmental quality objective GOOD-QUALITY GROUNDWATER. Groundwater must provide a safe and sustainable supply of drinking water and contribute to viable habitats for flora and fauna in lakes and watercourses.
Swedish environmental quality objective A BALANCED MARINE ENVIRONMENT, FLOURISHING COASTAL AREAS AND ARCHIPELAGOS. The north sea and the Baltic Sea must have a sustainable productive capacity, and biological diversity must be preserved. Coasts and archipelagos must be characterised by a high degree of biological diversity and a wealth of recreational, natural and cultural assets. Industry, recreation and other utilisation of the seas, coasts and archipelagos must be compatible with the promotion of sustainable development. Particularly valuable areas must be protected against encroachment and other disturbance.
Swedish environmental quality objective THRIVING WETLANDS. The ecological and water-conserving function of wetlands in the landscape must be maintained and valuable wetlands preserved for the future.
Swedish environmental quality objective SUSTAINABLE FORESTS. The value of forests and forest land for biological production must be protected, at the same time as biological diversity and cultural heritage and recreational assets are safeguarded.
Swedish environmental quality objective A VARIED AGRICULTURAL LANDSCAPE. The value of the farmed landscape and agricultural land for biological production and food production must be protected, at the same time as biological diversity and cultural heritage assets are preserved and strengthened.
Swedish environmental quality objective A MAGNIFICENT MOUNTAIN LANDSCAPE. The pristine character of the mountain environment must be largely preserved, in terms of biological diversity, recreational value, and natural and cultural assets. Activities in mountain areas must respect these values and assets, with a view to promoting sustainable development. Particularly valuable areas must be protected from encroachment and other disturbance.
Swedish environmental quality objective A GOOD BUILT ENVIRONMENT. Cities, towns and other built-up areas must provide a good, healthy living environment and contribute to a good regional and global environment. Natural and cultural assets must be protected and developed. Buildings and amenities must be located and designed in accordance with sound environmental principles and in such a way as to promote sustainable management of land, water and other resources.
Swedish environmental quality objective A RICH DIVERSITY OF PLANT AND ANIMAL LIFE. Biological diversity must be preserved and used sustainably for the benefit of present and future generations. Species habitats and ecosystems and their functions and processes must be safeguarded. Species must be able to survive in long-term viable populations with sufficient genetic variation. Finally, people must have access to

a good natural and cultural environment rich in biological diversity, as a basis for health, quality of life and well-being.
Increase measures at the local level to achieve the Swedish environmental quality objectives
Increase efforts to reach the Swedish Food strategy where total food production increases, while relevant national environmental and climate goals are reached and sustainable growth and employment are created

Table 97 concludes with the final outcomes of the PESTLE analysis performed for the Norrbotten case study, considering also all previous inputs from the other activities as well as the basis of the vulnerable sectors, challenges and goals.

Table 97. PESTLE analysis of local drivers of Norrbotten Case Study (final activity)

POLITICAL NORRBOTTEN CS local drivers
No regional strategy for climate adaptation
Different levels of government conflicting (e.g., Sami parliament / National government or National government/regional authorities). ***Justification***: The Sami Parliament is counted as an authority under the government, and has less power than a municipality because the Sami Parliament does not have control over land use (beyond Sami land use). The county administrative boards must take Sami interests into account in, for example, permit matters relating to changed land use - i.e. a form of guardianship/paternalism. This system is strongly criticized by the Sami, researchers and the UN.
Municipalities can have their own policies and drivers for local initiatives
National interest areas, "riksintresse", directs land use and land use change, but it is to some extent unclear how to prioritize between different overlapping national interests. Examples of national interests are military defense, water resources, energy production, exploitable mineral resources, nature preservation, and reindeer herding. This means that protected areas might still be exploited if some other valuable resource is found in the area.
Municipal master plans, "översiktsplan", provides a general indication of land use within the municipality, but the plans are not legally binding. Municipalities commonly also formulate specific thematic additions to the master plan, for example about wind-power. Thus, the municipality may or may not follow the master plan or thematic additional plans when making decisions that concerns land use. Municipal development plans, "detaljplan", of built areas are legally binding and can be perceived as a strong driving force in relation to land use - especially in relation to building permits and risk of flooding which relates to climate change and climate change adaptation.
Norrbotten regional climate targets: • **2030**: 63 % lower CO_2 emissions than 1990 • **Sector goal 2030**: 70 % lower emissions for domestic transport (excluding flight) than 2010 • **2040**: 75 % lower CO_2 emissions than 1990 • **2045**: Net zero CO_2 emissions Net zero net emissions of CO_2 (greenhouse gases) here means that emissions from operations in Sweden must be at least 85 percent lower than in 1990. Any remaining emissions can be compensated through so-called supplementary measures. These measures can also contribute to negative net emissions after 2045.
Norrbotten regional energy targets: • **2030**: 50% more efficient energy usage than in 2005 (added energy per BRP-Swedish crown) • **2040**: 100% renewable electricity production (but it's not a cut-off date that bans nuclear power)
Norrbotten's climate and energy strategy 2020–2024
Regional development strategy for Norrbotten 2030
Regional strategy for innovative and sustainable development of the mineral sector
ECONOMIC NORRBOTTEN CS local drivers

Municipalities - finance climate adaptation measures. (Some municipalities have started to use the VA tax or green bonds to finance climate adaptation.)
Rural development program (Landsbygdsprogrammet) - A possible financier (for municipalities, water management areas or the County Board) to implement climate adaptation measures in rural areas.
The LIFE Programme (the EU's funding instrument for the environment and climate action) - Funds can be applied for special vulnerability assessments at regional or cross-border level.
LOVA grants (from the County Administrative Board) - can be applied for by municipalities and associations for local measures that improve the sea and water environment.
LONA grants - Municipalities can apply for grants (up to 50%) to carry out projects that benefit nature conservation, outdoor life and public health, for example for wetlands, measures that benefit pollinators, restoration of natural areas and area protection and knowledge-raising efforts.
MSB (Swedish Civil Contingencies Agency) - municipalities can apply for funds (subsidy for natural disasters) for measures that prevent floods, landslides and erosion.
Increased rate for water and sewerage (VA tax) - to fund increased capacity of water mains to handle future rains.
Green bonds - investors that support investment projects in climate adaptation. "Kommuninvest" is an actor that municipalities can turn to finance climate adaptation efforts through so-called "green loans".
Investment support for diversification into other than agriculture - Support for investments if you have an agricultural company, horticultural company and reindeer husbandry company and want to invest in other activities. The aim is to develop business in rural areas to create growth and employment. It can be about tourism, nursing, contracting, etc.
Investment support for irrigation dams (2023-2027) - To adapt agriculture to a changing climate in order to maintain or increase production, save groundwater and avoid withdrawals from watercourses during periods of low water flow
Investment support for water conservation measures in the agricultural landscape (2023-2027), for example to create or restore wetlands.
Compensation from hydro-power ("bygdemedel") to affected local and Saami communities as well as municipalities
Electricity costs in northern Sweden are still low (compared with southern Sweden) - which affects attitudes towards energy efficiency.
Market expectations about the carbon performance of assets and products becoming higher
Demand from the market of certificated wood products
Enhance the circular economy through the use of biomass coming from trees
Competition for natural resources (driven by development of costs within e.g., the energy sector, construction sector etc.) - efficient use of natural resources.
Increased feeding costs in the reindeer industry - due to climate change effects on grazing and herding.
SOCIAL NORRBOTTEN CS local drivers
14 local divisions of the Swedish Society for Nature Conservation in Norrbotten. The NGO engages in activism and political lobbying.
Facilitation of recreational activities. For example: • Easy access information through the digital outdoor map ""naturkartan"" • Outdoor activities on prescription to encourage physical activity and well-being
New employment opportunities in mining, mineral processing and steel production sectors could generate immigration from other parts of Sweden as well as other countries. These jobs relate to the low-carbon transition, but the sectors are or have been male-dominant. Thus, pre-existing demographic gender imbalances due to selective population shrinkage could become exacerbated.
New employment opportunities in the wind-power sector and hydrogen sector could generate immigration from other parts of Sweden as well as other countries.

More employment and immigration generate tax-revenue which benefits the population of Norrbotten through the public sector (care, primary and secondary education). In turn, the public sector could also grow in terms of employment opportunities, which might reduce or prevent further demographic gender imbalance since the public sector is or has been more female-dominated.
Promotion and conservation of cultural heritage through information on world heritage sites, such as Laponia, and how to visit and experience them, as well as subsidies for conservation of cultural heritage sites and buildings.
Alliances between environmental NGOs and local Sami communities in relation to natural resource extraction (mining, forestry, renewable energy). This could raise the general public's awareness of environmental injustice and indigenous rights both at a national level and within Norrbotten.
Legal processes between Sami communities and mining could potentially result in further awareness of environmental injustice and recognition of indigenous rights
County administrative board provides intersectional analysis, strategies for regional gender equality, as well as support and coordination of implementation of gender equality policies at regional and municipal levels. Priorities 2018-2023: • Equal access to education (reduce gender division of labour market by targeting social norms) • Equal access to health care (equalize health differences between social groups through systematic work) • End men's violence against women (regional adaptation and implementation of UN CEDAW 1979 and EU Istanbul Convention 2011)
Four LEADER areas (locally initiated development) in Norrbotten which provides support and funding for non-profit NGOs to undertake local development projects.
Norrbotten division of the rural development NGO "Hela Sverige ska Leva" who works with various initiatives to improve public transport and maintain access to private and public services outside of population centres.
The climate justice group XR, and the subgroup "Rebellmammorna", are active in Norrbotten.
TECHNICAL NORRBOTTEN CS local drivers
New green house in Boden Municipality producing vegetables on waste heat from data centre.
Both Hapraranda Municipality and Överkalix Municipality are planning to use old peat extractions to produce solar farms.
Off-shore windfarm outside Kalix municipality cost on the border of Haparanda municipality sea borders.
Off-shore windfarm Bores Crown, 140 windmills producing 13,8 TwH/year located in both Lulea and Pitea municipality.
Bottnia off-shore 70 windmills 5,6 TwH/year starting 2032 south east of Lulea territorial sea border located on national territory.
New hydrogen system including a pipleline from Skelleftea municipality to Wasa municipality in Finland.
On shore windfarms 373 windmills in Gallivare municipality. Still on drawing table.
Development of wind power technology (higher towers, de-icing, and gear-free turbines) has enabled wind-power in northern forested areas, and can therefore be considered a fundamental technical driver of the contemporary northern wind-power expansion.
There are ongoing projects in railway, both maintaining the existing, as well as electrification of railway lines and building new ones. For example, the railway between Luleå and Haprandra was recently reopened for public transport.
The SMALL-project, Smart Viable Countryside. Utilization of digital technology in rural areas to improve access to services, and enable remote working.
Broadband is being built in the countryside, with the goal that all of Sweden should have access to high-speed broadband
Fossil free steel industry is being developed in Norrbotten, as well as recycling of metals and utilising rare metals and phosphorous in mining waste

157 windmills in Overkalix municipality. Pajala municipality 30 windmills. Confirmed and in process to be built. Another 30 windmills are today being processed.
LEGAL NORRBOTTEN CS local drivers
Permits are required for interventions that may affect exploitation of natural resources
Operations have a major impact on the environment are required under the Swedish law to compile environmental report to relevant authorities like the County Administrative Board of Norrbotten and, in some cases, the municipalities in which they operate.
Climate adaptation is to a large extent guided by existing legislation, frameworks, and targets, both national and international. Examples include the work on Agenda 2030 and on the Swedish Environmental Quality Objectives.
The Planning and Building Act legislation specifies planning and building regulations requiring local authorities to outline their views on climate-related risks in their comprehensive planning.
The Ordinance on Adaptation (2019) regulates the adaptation work of 32 national agencies and the 21 County Administrative Boards. They shall complete climate- and vulnerability analyses, complete adaptation action plans, take account of adaptation in their public procurement, and monitor the results of their work.
Municipalities must report the risks that climate change causes to what is built in the municipality in their master plan
The county administrative boards play an important role in coordinating climate adaptation activities with within the county and across municipal borders
The Swedish Environmental code is applied so that the use of land, water and the physical environment in general is such as to secure long-term good management in ecological, social, cultural and economic terms
The Reindeer Husbandry law "Rennäringslag" (1971:437) regulates sami land use (usufruct rights), who is considered an indigenous rights holder (member of a Saami community), as well as membership in Saami communities. The law is criticized for being exclusionary (only 10% of the sami population are entitled for membership in a sami community), and insufficient in terms of protecting sami land use from other competing land uses.
The Swedish Environmental Code, chapter 4, states that the mountain areas of Sweden, along with named other areas with valuable nature, are areas of national interest and that exploitation there are not allowed to significantly damage the natural and cultural assets of these areas, but with exceptions concerning local industry and the total defence
Voluntary Nature conservation agreements between the County Administrative Board and landowners can contribute to climate adaptation
ENVIRONMENTAL NORRBOTTEN CS local drivers
Increased tree growth due to warmer climate, leading to faster release of nutrients in soils, longer growing season and less severe temperatures. Increased tree growth means larger carbon capture and more harvestable biomass.
Increased productivity in agriculture and increased number of possible crop species, because of a warmer climate.
More precipitation (mostly during winter) leads to more water for hydropower (and more flooding). More precipitation could lead to more widespread and wetter wetlands, which could lead to larger carbon capture.
Milder climate is positive for many species (and negative for many others) (some of the favoured species are negative for the ecosystems, or the reindeer herding, forestry or agriculture production). Some favoured species contribute to larger storage of carbon in soils (for example earth worms).
Warmer winters due to climate change that reduce the heating needs (energy consumption reduction).
Relatively large areas (although not large enough to reach enviromental objectives) of nature are protected, and EU demands larger areas in the future. Protected forest capture carbon and protect biodiversity.
Recovery of the ozone layer (which might become reversed in Arctis because of climate change) leads to increased (or less stunted) growth of biomass, for example in the Swedish mountain chain.
Wetlands and streams are being restored, leading to increased biodiversity and better ecosystem functioning in those places (but the overall status of wetlands has a negative trend, whereas the trend is positive for lakes and streams).

The still ongoing postglacial isostatic uplift in northern Sweden means that Norrbotten will not experience increased sea level due to climate change when most other areas globally will. Coastal towns will not be negatively affected, as they will almost everywhere else, which might bring a relative advantage to Norrbotten society when development and localisations of industries are considered.
Continuous cover forestry is increasing, although still very rare, and can be a better alternative for biodiversity and reindeer herding.
Norrbotten County have many areas on land and off shore, with high wind speeds, where wind energy is feasible (often, but not always, in conflict with other interests)

11.7. Annex 7. Case Study 4 – Mediterranean Region (Murcia): Past experience and legal framework analysis

Table 98. Relevant documents identification of CS4 Murcia Region (those with the first column in green are the ones selected for the deeper analysis)

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
1	**Climate Change in the Region of Murcia: from the Paris Agreement to the climate emergency** | *(ES: Cambio climático en la Región de Murcia: del acuerdo de París a la emergencia climática)*	Roadmap	https://www.carm.es/web/pagina?IDCONTENIDO=9665&IDTIPO=100&RASTRO=c864$m	Regional	2021	• Agriculture, forestry and fishing • Water and waste • Biodiversity and natural heritage	Based on the Regional Strategy for Mitigation and Adaptation to Climate Change, this document sets the roadmap for the adaptation objective: promote and reduce the vulnerability of the region. It also contributes with instruments and policies to the mitigation objective in the goal of reducing the emissions by 26% in 2030.
2	**Strategy for Mitigation and Adaptation to Climate Change in the Region of Murcia** | *(ES: Estrategia de Mitigación y Adaptación al Cambio Climático de la Región de Murcia)*	Strategy	https://www.carm.es/web/pagina?IDCONTENIDO=9665&IDTIPO=100&RASTRO=c864$m	Regional	2019	• Society • Water and waste • Energy • Biodiversity and natural heritage • Transport	Current Murcia Region strategy on Climate Change adaptation and mitigation. Main objectives: reduce emissions from diffuse sectors by 26% in 2030 and achieve a region less vulnerable to climate change.
3	**Climate Change projections graphs for the 21st century: Region of Murcia** | *(ES: Gráficos de proyecciones de cambio climático para el siglo XXI: Región de Murcia)*	Other	https://www.aemet.es/es/serviciosclimaticos/cambio_climat/result_graficos?opc4=0&opc1=mur&opc6=0	Regional	2020	-	Evolution graphs and statistical regionalization on: change in maximum temperature, change in duration of heat waves, change on warm days.
4	**Report on Climate Change scenarios at local and regional level** (Life Adaptate Project)	Other	https://lifeadaptate.eu/wp-content/uploads/C1-20180405-Report-on-climate-change-scenarios.pdf	Regional	2020	• Cities and urban planning	Guide supporting the decision making on adaptation policies, it is paramount to gather data on key changes affecting climate variables and elements.
5	**Assessment of risk and vulnerabilities in municipalities in 3 EU countries** (Life Adaptate Project)	Other	https://lifeadaptate.eu/wp-content/uploads/Deliverable-D.10.-Risks-and-Vulnerabilities-Assessment.pdf	Other	2020	• Cities and urban planning	Particular exercise of some 6 municipalities in Spain, Portugal and Latvia.

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
6	**Didactic Unit on climate change** (Life Adaptate Project)	Guideline	https://lifeadaptate.eu/wp-content/uploads/Didactic-Unit-Climate-Change-LR.pdf	Other	2021	• Society	Tool to make climate change comprehensible for society.
7	**Guide to including Climate Change Mitigation and Adaptation in Local Policies** (Life Adaptate Project)	Guideline	https://lifeadaptate.eu/wp-content/uploads/EN_Guidelines-of-local-policies-to-the-needs-of-CCA.pdf	Other	2020	• Cities and urban planning	Methodological guide for municipalities willing to adapt local policies to climate change requirements.
8	**Draft Ordinance regulating the integration of climate change in urban planning authorisation and management procedures and in the granting of building and activity licences** (Life Adaptate Project)	Law	https://lifeadaptate.eu/wp-content/uploads/Lifeadaptate-draft-local-regulation-to-align-local-policies-with-CC_v2.pdf	Other	2021	• Cities and urban planning	Sort of pre-legal document regulating climate change in new building and economic licenses at local level.
9	**A guide for municipalities to adapt to climate change & How it has been done by pilots in Life Adaptate Project**	Other	https://lifeadaptate.eu/wp-content/uploads/PA-article-LIFE-Adaptate.pdf	Other	2022	• Cities and urban planning	This guide explains pilot actions in six municipalities that were implemented to adapt to climate change at a local level within the Life Adaptate Project.
10	**Call for grants on energy efficiency for industrial companies in the Murcia region**	Other	https://www.institutofomentomurcia.es/web/portal/eficiencia-energetica	Regional	2019	• Energy	Encourage and promote the performance of actions in SMEs and large companies in the industrial sector that reduce carbon dioxide emissions and final energy consumption, by improving energy efficiency.
11	**Platform on Adaptation to Climate Change in Spain - AdapteCCa** | *(ES: Plataforma sobre Adaptación al Cambio Climático en España)*	Other	https://adaptecca.es/administracion-local/comunidades-autonomas/ccaa?field_ccaa_value=14	National	2015	• Society	Spanish platform for Climate Change: information per regions.
12	**Murcia region climate change web site**	Other	http://cambioclimaticomurcia.carm.es/	Regional	2018	• Society • Agriculture, forestry and fishing • Water and waste • Biodiversity and natural heritage	Thematic web site of the regional public authority.

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
13	**Integrated National Plan for Energy and Climate 2021-2030 (NECP)** | *(ES: Plan Nacional Integrado de Energía y Clima 2021-2030 - PNIEC)*	Plan	https://www.miteco.gob.es/images/es/pnieccompleto_tcm30-508410.pdf & https://energy.ec.europa.eu/system/files/2021-01/staff_working_document_assessment_necp_spain_en_0.pdf	National	2020	• Energy	It is the Spanish commitment and contribution to the international and European effort to the climatic crisis, structured in five dimensions: decarbonisation, including renewable energy; energy efficiency; energy security; internal energy market and research, innovation and competitiveness.
14	**National Plan for Adaptation to Climate Change (NAP) 2021-2030** | *(ES: Plan Nacional de Adaptación al Cambio Climático 2021-2030 - PNACC)*	Plan	https://www.miteco.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/pnacc-2021-2030_tcm30-512163.pdf	National	2021	• Waste and waste • Biodiversity and natural heritage • Agriculture, forestry and fishing • Tourism, cultural heritage • Energy • Transport • Industry and commerce	It is the basic planning instrument to promote coordinated and coherent action against the effects of climate change in Spain, in order to avoid or reduce present and future damage caused by climate change and build a more resilient economy and society.
15	**Energy Plan for the Region of Murcia 2016-2020** | *(ES: Plan Energético de la Región de Murcia 2016-2020)*	Plan	https://www.museosregiondemurcia.es/documents/4106806/8264765/documento+completo_Rev2.pdf/ef6c8e7d-450e-42cf-a415-8bc9111bf5a1?version=1.0	Regional	2016	• Energy	The plan is structured around three main axis for planning: energy efficiency (in the industrial and tertiary sectors, agriculture, housing, local and regional administration, and waste), renewable energies (in the same levels as previous one), and infrastructures (to guarantee supply and through energy planning with electricity and gas companies).
16	**Special Civil Protection Plan against the Risk of Flooding in the Autonomous Community of the Region of Murcia** | *(ES: Plan Especial*	Plan	https://conocimientoabierto.carm.es/jspui/handle/20.500.11914/2127	Sectoral	2007	• Water and waste	The plan's aim is to establish the organization and action procedures of the public resources and services that intervene in an emergency due to the risk of flooding in the Region of Murcia. For the purpose of this Plan, it is

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
	de Protección Civil ante el Riesgo de Inundaciones de la Comunidad Autónoma de la Región de Murcia - INUMMUR)						considered: all those emergencies due to flooding from significant rainfall, breakage or breakdown of dams, or due to extraordinary flooding in any part of the channels that drain the regional space or that could affect it, as well as due to any other cause of flooding that represents a risk to the population and their property.
17	**Emergency Civil Protection Plan for Forest Fires in the Region of Murcia** | *(ES: Plan de Protección Civil de Emergencia por Incendios Forestales en la Región de Murcia - INFOMUR)*	Plan	https://conocimientoabierto.carm.es/jspui/handle/20.500.11914/2103	Sectoral	2021	• Agriculture, forestry and fishing	The main objective is to establish the hierarchical and functional organization, as well as the procedures for action of the resources and services whose ownership corresponds to the Autonomous Community of Murcia; in order to protect people, property and the environment in the event of fires forest.
18	**Forest Strategy of the Region of Murcia** | *(ES: Estrategia Forestal de la Región de Murcia)*	Strategy	https://murcianatural.carm.es/c/document_library/get_file?uuid=5881e6f2-95c7-46da-8dc5-60ff6d4af1f5&groupId=14	Sectoral & Regional	2020	• Agriculture, forestry and fishing • Biodiversity and natural heritage	It allows effective planning of the activities to be carried out by the Regional Administration in relation to forest management and nature conservation and an adequate allocation of means and resources. It is conceived as a strategic action plan aimed at the comprehensive management of the natural environment of Murcia according to the principles of sustainability, multi-functionality and conservation of biological diversity.
19	**Strategic Plan for the Agrifood Sector of the Region of Murcia** | *(ES: Plan Estratégico del Sector Agroalimentario de la Región de Murcia)*	Plan	https://www.carm.es/web/pagina?IDCONTENIDO=4582&IDTIPO=100&RASTRO=c80$m22721,22746	Sectoral & Regional	2007	• Agriculture, forestry and fishing • Industry and commerce	It deeps and determines the appropriate strategies to deal with the external and internal environment of the agrifood sector in Murcia, that affect the profitability of their companies, to deal with them successfully and improve the competitiveness of the sector.
20	**Regional Strategy for the Conservation and Sustainable Use of Biological Diversity** | *(ES: Estrategia Regional para la Conservación y el uso sostenible de la diversidad biológica)*	Strategy	https://murcianatural.carm.es/web/guest/estrategias/-/journal_content/56_INSTANCE_9GoI/14/84596	Sectoral & Regional	2004	• Biodiversity and natural heritage	Strategic document for the environmental and regional policy, with scope for the future.
21	**Covenant of Mayors of the Region of Murcia for Climate and Energy** | *(ES: Pacto de las Alcaldías Región de Murcia por el Clima y la Energía)*	Other	https://www.pactoalcaldesregmurcia.es/	Regional	-	• Energy	INFO Murcia, as the structure of support for Covenant of Mayors in the Region of Murcia, promotes the adhesion of the municipalities of Murcia Community, to the adoption of energy efficiency measures and invites them

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
							to meet the objective of the EU for 2030, i.e. at least 40% reduction in GHG emissions, at least 32% share of RES, at least 32.5% improvement in energy efficiency; as well as to establish the adaptation plan to climate change for the municipalities.

The sections below include the detailed analysis of the most relevant documents performed within the Murcia Region Case Study.

11.7.1. Annex 4.1. Deep analysis of document #1 of CS4

Table 99. Document #1 of CS4 Murcia Region deeply analysed

Case Study	**CS4 – Mediterranean Region Murcia Region (ES)**		
#1	**Climate Change in the Region of Murcia: from the Paris Agreement to the climate emergency** | *(ES: Cambio climático en la Región de Murcia: del acuerdo de París a la emergencia climática)*		
Type of document	Roadmap	**Language(s)**	Spanish
Scope	Regional	**Year of adoption**	2021
Web link	https://www.carm.es/web/pagina?IDCONTENIDO=9665&IDTIPO=100&RASTRO=c864$m	**Target year**	2030
Brief description	Based on the Regional Strategy for Mitigation and Adaptation to Climate Change, this document sets the roadmap for the adaptation objective: promote and reduce the vulnerability of the region. It also contributes with instruments and policies to the mitigation objective in the goal of reducing the emissions by 26% in 2030.		
Sectors involved	Agriculture, forestry and fishing	Water and waste	Biodiversity and natural heritage
Main target addressed	The declaration of climate emergency for the Region of Murcia, also acquires the commitment to be carbon neutral in 2050. And, as second commitment, it includes to "demand the need for the allocation of European funds to consider the vulnerability of the regions to climate change". The potential of a region to face these impacts is its adaptive capacity. This depends on the strength of its economy and the structures to respond with research and development to new challenges. Regional economy faces another great challenge: the growing demand for reducing emissions. Half of the annual emissions from the Region of Murcia comes from 21 large industrial facilities, among which the oil refinery and various electricity production plants stand out. The Regional Administration is in charge of applying strict European regulation to these 21 industrial facilities, which are assigned increasingly reduced emission rights.		
Other relevant objectives or strategies addressed			
O1	Current stage and future tendencies of the Climate change in the Murcia region		
O2	Climate change and hydric resources: current state in the Murcia region		
O3	Monitoring the climate change in the river nature reserves in the Murcia region		
O4	Impact of floods on the environmental health of children and youth in the Mar Menor		
O5	Increasing the resilience to climate change of coastal forests		
O6	Response of forests formations in the Region of Murcia to extreme events of drought and climate change		
O7	Agro-ecological innovation observatory against climate change: recovery of fruit trees		
O8	Adoptable crops in the Region of Murcia facing climate change (quinoa)		
O9	Study of tolerance to salinity and drought in promising crops (amaranth and quinoa)		
O10	Characterisation of varieties of moringa, quinoa and amaranth destined to evaluate future food uses		
O11	Ecosystem-based adaptation, a new theory for Mediterranean rain-fed agriculture adaptation to climate change		
O12	The institutional declaration of the climate emergency and the approval of the strategic planning of the Region of Murcia		

O13	Integrate climate change in plans and projects subjected to environmental assessment. Experience gained, methods and tools developed
O14	Voluntary agreements for the mitigation and adaptation to climate change. Basic elements to consider
O15	The integration of climate change in the procedures for granting works and activity licenses. Key elements for a city ordinance
O16	Transition to a carbon neutral economy and sustainable finances
Relevant policies and measures included	
[Related to O14 – Voluntary agreements for the mitigation and adaptation to climate change, basic elements to consider]	
P&M1	Voluntary agreements in the current law on integrated environmental protection
P&M2	Offset for emissions that cannot be reduced
P&M3	Emissions offset based on domestic actions or projects
P&M4	Objective to reduce or offset 26% of emissions by 2030
P&M5	Focus efforts on scope 1 emissions of the carbon footprint
P&M6	Conditions for reduction or compensation to be accepted as such
P&M7	Mitigation targets (26% reduction or offset) are common, adaptation those must be specific for each organisation and circumstances
P&M8	Focus the effort on those organisations that make a greatest contribution to climate change
P&M9	Choose a simple and zero-cost communication mechanism based on the responsible statement
P&M10	The efforts made, as well as certificates by the environmental administration, which acts as notary and guarantor of their truthfulness, must have social recognition
Actuation areas	Region of Murcia
Additional relevant information	Complementary with the new regional strategy for mitigation & adaptation to climate change

11.7.2. Annex 4.2. Deep analysis of document #2 of CS4

Table 100. Document #2 of CS4 Murcia Region deeply analysed

Case Study	**CS4 – Mediterranean Region Murcia Region (ES)**		
#2	**Strategy for Mitigation and Adaptation to Climate Change in the Region of Murcia** | *(ES: Estrategia de Mitigación y Adaptación al Cambio Climático de la Región de Murcia)*		
Type of document	Strategy	**Language(s)**	Spanish
Scope	Regional	**Year of adoption**	2019
Web link	https://www.carm.es/web/pagina?IDCONTENIDO=9665&IDTIPO=100&RASTRO=c864$m	**Target year**	2030
Brief description	Current Murcia Region strategy on Climate Change adaptation and mitigation. Main objectives: reduce emissions from diffuse sectors by 26% in 2030 and achieve a region less vulnerable to climate change.		
Sectors involved	Society	Water and waste	Energy
	Biodiversity and natural heritage	Transport	
Main target addressed	Mitigation and adaptation to the effects of climate change.		

Other relevant objectives or strategies addressed	
O1	**Reduce emissions from diffuse sectors by 26% in 2030**. This objective is consistent with the commitments assumed by the European Union that binds Spain and that must be ordered as mandatory limits for companies and organisations in operation
O2	**Achieve a region less vulnerable to climate change**. This objective adds to the previous one of reducing emissions, since it is necessary to adopt adaptation measures to face the climate effects and reduce the economic and environmental costs that these will entail.
Relevant policies and measures included	
P&M1	Incorporate adaptation and mitigation measures into new plans and projects through the environmental assessment procedure.
P&M2	Promote environmental agreements (voluntary agreements) for adaptation and mitigation.
P&M3	Identify and disseminate mitigation and adaptation actions that are eco-efficient, that is, in addition to being environmentally favourable, they are economically advantageous.
P&M4	Focus mitigation efforts on the most important source of greenhouse gas emissions in the region by reducing the use of private vehicles and electrifying mobility.
P&M5	Take advantage of the legal obligation of the "near zero energy consumption building" to incorporate, through building permits, mitigation and adaptation measures.
P&M6	Encourage companies and business sectors to develop strategic analyses of adaptation to climate change and encourage from the institutions the generation of knowledge about the effects and measures of adaptation to climate change of the key sectors in the regional economy.
P&M7	Promote communication of the carbon footprint and voluntary efforts in mitigation and adaptation, especially among the exporting fabric.
P&M8	Apply future scenarios of sea level rise in urban decision-making on the coast and initiate the adaptation of urban spaces and infrastructures that are foreseeably affected.
P&M9	Promote the adaptation to climate change of the natural environment in its aspects related to the conservation of biodiversity and protected areas.
P&M10	Promote the adaptation to climate change of the natural environment in its aspects related to forest management.
P&M11	Strengthen public health by acting against climate change.
P&M12	Promote a regional public administration of zero emissions, and develop training and awareness actions in all areas with special reference to the citizen as a consumer in their contribution to climate change.
P&M13	Promote adaptation and mitigation at the municipal level through the action plans for climate and sustainable energy (SECAP) of the European Covenant of Mayors initiative.
P&M14	Review of the FEDER investment planning, at the initiative of the Autonomous Community.
P&M15	Begin the path so that the vulnerability of the Region of Murcia to climate change is considered in the allocation of European funds.
Actuation areas	Region of Murcia
Additional relevant information	-

11.7.3. Annex 4.3. Deep analysis of document #13 of CS4

Table 101. Document #13 of CS4 Murcia Region deeply analysed

Case Study	**CS4 – Mediterranean Region Murcia Region (ES)**		
#13	**Integrated National Plan for Energy and Climate 2021-2030 (NECP)** | *(ES: Plan Nacional Integrado de Energía y Clima 2021-2030 - PNIEC)*		
Type of document	Plan	**Language(s)**	Spanish, English
Scope	National	**Year of adoption**	2020
Web link	https://www.miteco.gob.es/images/es/pnieccompleto_tcm30-508410.pdf & https://energy.ec.europa.eu/system/files/2021-01/staff_working_document_assessment_necp_spain_en_0.pdf	**Target year**	2030
Brief description	It is the Spanish commitment and contribution to the international and European effort to the climatic crisis, structured in five dimensions: decarbonisation, including renewable energy; energy efficiency; energy security; internal energy market and research, innovation and competitiveness.		
Sectors involved	Energy		
Main target addressed (#1)	**DECARBONISATION: 23% reduction of greenhouse gas (GHG) emissions** by 2030 with respect to 1990.		
Other relevant objectives or strategies addressed			
O1	**Electrification and decarbonisation of energy system: RES up to 42%** of final energy use by 2030.		
O2	**Transport**: 28% of RES in transport through electrification and biofuels.		
O3	**Heating and cooling**: electrification and increase in the use of thermal RES.		
O4	**Electricity generation: 74% of generation from RES** in the electricity mix by 2030, promoting both storage and demand management for RES integration.		
O5	Adoption of instruments and measures to facilitate and strengthen the role of **local energy communities** and new actors in energy transition, as well as guarantee the right of **access to energy.**		
Relevant policies and measures included			
P&M1	Development of new power generation facilities with renewables		
P&M2	Demand management, storage and flexibility		
P&M3	Adaptation of electrical networks for the integration of renewables		
P&M4	Incorporation of renewables in the industry sector		
P&M5	Framework for the development of thermal renewable energies		
P&M6	Advanced biofuels in transport		
P&M7	Promotion of renewable gases		
P&M8	Technological renewal plan in existing electricity generation projects with RES		
P&M9	Promotion of bilateral contracting of renewable electricity		
P&M10	Specific programmes for the use of biomass		
P&M11	Local energy communities		
P&M12	Promotion of active role of citizens in decarbonisation [2]		
P&M13	Just Transition Strategy		
P&M14	Public procurement of renewable energy		

P&M15	Training of professionals in the renewable energy sector
P&M16	Review and simplification of administrative procedures
P&M17	Reduction of GHG emissions in the agricultural and livestock sectors
P&M18	Reduction of GHG emissions in waste management
P&M19	Reduction of GHG emissions related to fluorinated gases
P&M20	Forest sinks
P&M21	Agricultural sinks
Main target addressed (#2)	**ENERGY EFFICIENCY: 39.5% improvement in energy efficiency** by 2030.
Other relevant objectives or strategies addressed	
O6	Final accumulated **energy savings** objective is equivalent to 36,809 Ktoe (from 2021 to 2030)
O7	**Energy retrofitting of buildings**: improvement of energy efficiency of thermal envelope (1,200,000 dwellings) and renewal of thermal heating and DHW installations (300,000 dwellings per year on average).
O8	**Energy retrofitting of public buildings**: energy retrofitting of public building stock (300,000 m2 per year) and energy retrofitting of 3% of built and heated public area.
Relevant policies and measures included	
P&M22	Low emission zones and modal shift measures
P&M23	More efficient use of means of transport
P&M24	Renewal of the vehicle fleet
P&M25	Electric Vehicle boost
P&M26	Improvements in technology and industrial process management systems
P&M27	Energy efficiency in existing buildings in the residential sector
P&M28	Renovation of residential equipment
P&M29	Energy efficiency in the building stock of tertiary sector
P&M30	Energy efficiency in cold generation equipment and large air conditioning installations in the tertiary sector and public infrastructures
P&M31	Energy efficiency in farms, irrigation communities and agricultural machinery
P&M32	Promotion of energy services
P&M33	Public sector: proactive responsibility and energy efficient public procurement
P&M34	Energy audits and management systems
P&M35	Training of professionals in the energy efficiency sector
P&M36	Communication and information on energy efficiency
P&M37	Other measures to promote EE: transition in high-efficiency co-generation
P&M38	Financial measures: National Energy Efficiency Fund
Main target addressed (#3)	**ENERGY SECURITY: reducing energy dependency 12%** by 2030 (from 73% in 2017 to 61% in 2030).
Other relevant objectives or strategies addressed	

O9	**Diversification** of both energy sources and countries of origin of the supply.
O10	**Resilience**: preparation against possible limitations or interruptions of energy supply.
O11	**Flexibility** increase of the system, from possibilities of the demand side of the energy consuming sectors.
Relevant policies and measures included	
P&M39	Maintenance of minimum security stocks of oil and gas products
P&M40	Alternative fuel refill products
P&M41	Planning for the safe operation of a decarbonised system
Main target addressed (#4)	**ENERGY INTERNAL MARKET: electrical interconnection up to 15%** by 2030.
Other relevant objectives or strategies addressed	
O12	**Electric transport infrastructure**: renewables integration.
O13	**Electric market integration**
O14	**Gas market integration**
O15	**Protection of vulnerable consumers**
Relevant policies and measures included	
P&M42	Electricity transmission infrastructures other than "Projects of Common Interest" (PCIs)
P&M43	Integration of the electricity market
P&M44	Protection of electricity consumers and increased competence
P&M45	Data access
P&M46	Gas market integration
P&M47	Protection of gas consumers
P&M48	Improvement of the competitiveness of the retail gas sector
P&M49	Gas demand management development plan
P&M50	Fight against energy poverty
Main target addressed (#5)	**RESEARCH, INNOVATION AND COMPETITIVENESS**
Other relevant objectives or strategies addressed	
O16	**Objectives for research and innovation**
O17	**Objectives for financing**
O18	**Specific targets for low-carbon and clean energy technologies**
O19	**The competitiveness of the economy**
Relevant policies and measures included	
P&M51	Strategic Action in Energy and Climate
P&M52	Implementation of the SET-Plan
P&M53	Increase, coordination, improvement and efficient use of scientific and technological infrastructures and equipment in energy and climate
P&M54	New instruments to support research and innovation in energy and climate

P&M55	Social innovation for the climate
P&M56	Reduction of bureaucratic procedures and administrative burdens
P&M57	Innovation System of Science, Technology and Innovation for monitoring funding
P&M58	European innovation financing mechanisms
P&M59	International cooperation
Actuation areas	National level, to be transposed in regional and local plans/ strategies
Additional relevant information	-

11.7.4. Annex 4.4. Deep analysis of document #14 of CS4

Table 102. Document #14 of CS4 Murcia Region deeply analysed

Case Study	**CS4 – Mediterranean Region Murcia Region (ES)**		
#14	**National Plan for Adaptation to Climate Change (NAP) 2021-2030** | *(ES: Plan Nacional de Adaptación al Cambio Climático 2021-2030 - PNACC)*		
Type of document	Plan	**Language(s)**	Spanish
Scope	National	**Year of adoption**	2021
Web link	https://www.miteco.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/pnacc-2021-2030_tcm30-512163.pdf	**Target year**	2030
Brief description	It is the basic planning instrument to promote coordinated and coherent action against the effects of climate change in Spain, in order to avoid or reduce present and future damage caused by climate change and build a more resilient economy and society.		
Sectors involved	Water and waste	Biodiversity and natural heritage	Agriculture, forestry and fishing
	Tourism, leisure, cultural heritage	Energy	Transport
	Industry and commerce		
Main target addressed	Adaptation approach in different sectors: Water; Biodiversity; Coasts and marine environment; Energy; Agriculture, forestry, desertification; Health; Territory; Other sectors; Society.		
Other relevant objectives or strategies addressed			
O1	**Climate and climate scenarios**		
Relevant policies and measures included			
P&M1	**Systematic climate observation, especially of essential climate variables (ECV)**		
P&M2	Meteorological observation for early warning and warning services of adverse weather and climate phenomena		
P&M3	Regionalized climate change projections for Spain		
P&M4	Climate services, to transform climate basic data and information into products and specific applications useful for different users		
P&M5	Training for the use of climate information		
Other relevant objectives or strategies addressed			
O2	**Human health**		

Relevant policies and measures included	
P&M6	Integration of climate change in the national health and environmental plan
P&M7	Preventive actions of the effects of excess temperatures on health
P&M8	Preparation and response to infectious and parasitic diseases promoted by CC
P&M9	Preventive actions to face atmospheric pollution episodes
P&M10	Preventive actions against the effects of climate change on the health of workers
Other relevant objectives or strategies addressed	
O3	**Water and water resources**
Relevant policies and measures included	
P&M11	Expanding and updating knowledge on the potential impacts of climate change on water and water resources management
P&M12	Integration of adaptation to climate change in hydrological planning and management of the integral water cycle
P&M13	Contingent risk management due to drought integrated in hydrological planning and water management
P&M14	Coordinated and contingent management of flood risks
P&M15	Actions to improve the state of water bodies and aquatic ecosystems, with impact on groundwater
P&M16	Monitoring and improving knowledge on the observable effects of climate change on water bodies and their uses
Other relevant objectives or strategies addressed	
O4	**Natural heritage, biodiversity and protected areas**
Relevant policies and measures included	
P&M17	Incorporation of the climate change factor in national conservation strategies and in plans for the conservation and recovery of endangered species
P&M18	Planning and management of protected areas with adaptive criteria
P&M19	Improvement the adaptive capacity of green infrastructure
P&M20	Control of invasive species
P&M21	Incorporation of the climate change factor in the conservation of types of natural and semi-natural habitats and in their adaptive management
Other relevant objectives or strategies addressed	
O5	**Forestry, desertification, hunting and inland fishing**
Relevant policies and measures included	
P&M22	Integration of climate change planning instruments with implications in the maintenance and improvement of forest resources
P&M23	Revision and updating of forest management guidelines and standards
P&M24	Promotion of the integration of climate change in policies and measures related to hunting and inland fishing
P&M25	Integration of climate projections and adaptation measures into policies and measures for fighting forest fire
P&M26	Expanding and updating knowledge on the climate impacts and risks and adaptation measures in the forestry, hunting and inland fishing sector and the fight against desertification
Other relevant objectives or strategies addressed	

O6	**Agriculture, livestock, fisheries, aquaculture and food**
Relevant policies and measures included	
P&M27	Expanding and updating knowledge on impacts, risks and adaptation in the main crops, livestock species, fisheries and aquaculture in Spain, as well as in the food sector, including the interrelation of all elements of the food system
P&M28	Strengthening of adaptation to climate change in Spain's post-2020 common agricultural policy
P&M29	Review of existing and future plans, regulations and strategies related to the agriculture, livestock, fisheries and aquaculture sectors, taking into account the new climate scenarios
P&M30	Promotion of practices that promote greater resilience to the impacts of climate change on the food system
P&M31	Development of communication actions on the relationship between food and climate change for a more responsible food consumption
P&M32	Strengthening of adaptation to climate change in the common fisheries policy (CFP), in national management and recovery plans and in the aquaculture sector
Other relevant objectives or strategies addressed	
O7	**Coast and marine environment**
Relevant policies and measures included	
P&M33	Development of tools for risk analysis and the definition of adaptation initiatives on the coast and sea
P&M34	Changes in the regulatory framework to facilitate adaptation on the coasts and the sea
P&M35	Integration of coastal risks in plans and programmes that include the coastal space
P&M36	Development of adaptation initiatives in the maritime-terrestrial public domain and related spaces
P&M37	Promote institutional coordination and social participation for adaptation on the coast and sea
Other relevant objectives or strategies addressed	
O8	**City, urbanism and building**
Relevant policies and measures included	
P&M38	Link and reinforcement between the Spanish Urban Agenda and the national plan for adaptation to climate change, as governance frameworks
P&M39	Integration of adaptation to climate change in territorial and urban planning
P&M40	Integration of adaptation to climate change in the building sector
P&M41	Communication, dissemination and citizen participation in the urban sphere
Other relevant objectives or strategies addressed	
O9	**Cultural heritage**
Relevant policies and measures included	
P&M42	Integration of risks derived from climate change in the conservation of cultural heritage
P&M43	Identification and transfer of useful vernacular knowledge for adaptation to climate change
P&M44	Promotion of a conscious cultural tourism, adapted to climate change and low carbon
Other relevant objectives or strategies addressed	
O10	**Energy**
Relevant policies and measures included	

P&M45	Integration in energy planning and management of changes in the supply of primary energy derived from climate change
P&M46	Prevention of the impacts of climate change on electricity generation
P&M47	Prevention of the impacts of climate change on the transport, storage and distribution of energy
P&M48	Management of changes in electricity demand associated with climate change
Other relevant objectives or strategies addressed	
O11	**Mobility and Transport**
Relevant policies and measures included	
P&M49	Observation, monitoring and surveillance systems of infrastructure operation
P&M50	Integration of the effects of climate change in the regulation for the calculation and design of transport infrastructures
P&M51	Existing structures: risks of climate change in the management and maintenance of transport infrastructures
P&M52	New structures: climate change risks in transport infrastructure planning
P&M53	Support and reinforcement of adaptation to climate change in public administrations and other sectors and agents
Other relevant objectives or strategies addressed	
O12	**Industry and services**
Relevant policies and measures included	
P&M54	Integration of adaptation in sectoral legislation and industrialization plans
P&M55	Identification of the risks of the Spanish industry and the services sector derived from climate change and promotion of the adoption of adaptation measures
P&M56	Encouragement to the generation of new products, production processes and services oriented to adaptation
Other relevant objectives or strategies addressed	
O13	**Tourism**
Relevant policies and measures included	
P&M57	Integration of adaptation in the plans, programmes and strategies in the field of tourism
P&M58	Protection of tourist resources, adaptation of infrastructures and facilities and promotion of their resilience against the effects of climate change
P&M59	Definition of more sustainable and more resilient tourism models to the impacts of climate change
P&M60	Knowledge generation and training and awareness actions in tourism supply and demand
Other relevant objectives or strategies addressed	
O14	**Finance system and insurance activity**
Relevant policies and measures included	
P&M61	Incorporation of climate change adaptation into sustainable finance initiatives
P&M62	Creation of incentives for risk prevention through the integration of adaptation in the insurance activity
P&M63	Stable frameworks of collaboration and coordination in matter of adaptation with the key actors of the financial system and the insurance activity
P&M64	Strengthening of capacities on adaptation in the financial system and the insurance activity

Other relevant objectives or strategies addressed	
O15	Disaster risk reduction
Relevant policies and measures included	
P&M65	Prospective assessment of disaster risks considering climate change projections and scenarios
P&M66	Integration of adaptive criteria in policies and measures to reduce disaster risk and in post-disaster actions
P&M67	Support and reinforcement of preparedness for disaster risk: observation, early warning, communication and education with climate change adaptation criteria
P&M68	Reinforcement of self-protection systems against climate disasters in risk communities
Other relevant objectives or strategies addressed	
O16	Research and innovation
O17	Education and society
O18	Peace, security and social cohesion
Actuation areas	National level (Spain)
Additional relevant information	-

11.7.5. Annex 4.5. Deep analysis of document #15 of CS4

Table 103. Document #15 of CS4 Murcia Region deeply analysed

Case Study	CS4 – Mediterranean Region Murcia Region (ES)		
#15	**Energy Plan for the Region of Murcia 2016-2020** | *(ES: Plan Energético de la Región de Murcia 2016-2020)*		
Type of document	Plan	**Language(s)**	Spanish
Scope	Regional	**Year of adoption**	2016
Web link	https://www.museosregiondemurcia.es/documents/4106806/8264765/documento+completo_Rev2.pdf/ef6c8e7d-450e-42cf-a415-8bc9111bf5a1?version=1.0	**Target year**	2020
Brief description	It is **outdated** but there is no more up-to-date document in terms of **sustainable energy** for the region of Murcia. Strategic objectives are around circular economy of energy, organised in three tactical objectives: 20% reduction of GHG emissions, 20% of energy consumption from RES, 20% increase of energy efficiency. In **2030** horizon, these objectives are projected as follows: 40% reduction of GHG emissions, >27% energy consumption from RES, 27% increase of energy efficiency.		
Sectors involved	Energy		
Main target addressed	The plan is structured around three main axis for planning: energy efficiency (in the industrial and tertiary sectors, agriculture, housing, local and regional administration, and waste), renewable energies (in the same levels as previous one), and infrastructures (to guarantee supply and through energy planning with electricity and gas companies).		
Other relevant objectives or strategies addressed			
O1	Guarantee the supply in safety conditions (of supply, legal and prevention) and quality with necessary infrastructures		
O2	Promote energy saving and efficiency in all areas		

O3	Promote the use of sustainable energy sources that guarantee competitiveness
Relevant policies and measures included	
BUSINESS	
P&M1	Use of residual heat from production processes to obtain water
P&M2	Advice on management of energy contracting in the business field
P&M3	Promotion of the management of centralized energy purchases
P&M4	Advice on energy management to business associations
P&M5	Promotion of the "Energy Cluster"
P&M6	Promote the role of regional Technology Centres in terms of sectoral EE
P&M7	Promotion of photovoltaic solar energy on the roofs of industrial buildings through measures that strengthen legal security for investments in renewable energy
P&M8	Promotion of energy efficiency in wastewater treatment plants
P&M9	Assessment of construction processes from an energy point of view. Catalogue of construction solutions based on their energy efficiency
P&M10	Use of low and medium temperature solar thermal energy in production processes
P&M11	Promotion of solar photo-catalysis for water decontamination and disinfection treatment
P&M12	Promotion of solar photo-catalysis for air purification
P&M13	Study on the potential of projects for the use of geothermal energy
P&M14	Promotion of Energy Service Companies
P&M15	Grants for the improvement and modernization of irrigation infrastructures
HOUSEHOLDS	
P&M16	Promotion of energy use in neighbouring communities
P&M17	Promotion of self-consumption in the domestic sector
P&M18	Study of energy efficiency in the domestic sector through certification
P&M19	Online courses on energy saving and efficiency
P&M20	Aid Plan for the acquisition of domestic electricity generation equipment from renewable energies
P&M21	Reduction of administrative fees for installations with renewable energies for private homes
P&M22	Promotion of training on energy efficiency and use of renewable energies from an early age
P&M23	Study on tax exemptions for homes with energy rating "A" and "B"
P&M24	Information campaigns for property managers and neighbourhood communities
P&M25	Advertising campaigns in the media and social networks on the advantages of saving and energy efficiency and the use of RES in the domestic sector
P&M26	Guidelines to guarantee the quality and technical suitability of equipment for small power renewable energy uses
P&M27	Subsidies for building retrofitting in the Region of Murcia
PUBLIC ADMINISTRATION	
P&M28	Energy efficiency plan in Administration buildings
P&M29	Use of public land and roofs for photovoltaic generation

P&M30	Use of renewable energies, generated in municipal treatment plants, for electricity self-consumption in the municipalities
P&M31	Promote the consideration of the carbon footprint in public contracts and value upwards the minimum footprint
INFRASTRUCTURES	
P&M32	Creation of infrastructures for the use of biomass
P&M33	Development of improvements in distribution networks
P&M34	Preparation of a Pareto chart of sectoral energy consumption
P&M35	Vehicle charging stations powered by renewable sources
P&M36	Promotion of hydrogen as an energy source in transport
P&M37	Evaluation of the capacity and saturation of the region's energy distribution networks
P&M38	Study and promotion of the integration of RES sources with the distribution and transport system
P&M39	Follow-up of the implementation of smart energy meters and grids
P&M40	Promotion of reforestation
P&M41	Improvement of infrastructures for collective transport
P&M42	Electrification of railways in the region
P&M43	Promotion of infrastructures at the service of electric vehicles
P&M44	Study of the unique infrastructures of hot water networks from solar thermal power plants
P&M45	Planning of the Electric Transmission Network
P&M46	Planning of the Electricity Distribution Network
P&M47	Gas Network Planning
P&M48	Promotion of tenders for hydroelectric exploitation in infrastructures
P&M49	Promotion of micro-hydroelectric projects
PEDAGOGY ENERGY	
P&M50	Measurement of energy efficiency
P&M51	Promotion of passive systems
P&M52	Promote the implementation of the ISO 50001 standard on energy efficiency
P&M53	Collaboration with the Universities of the Region in terms of energy saving and efficiency
P&M54	Promotion of the improvement of the equivalent electrical performance of cogeneration plants
P&M55	Promotion of the use of hydrogen and natural gas in the propulsion of ships
P&M56	Aid for the replacement of equipment of greater efficiency in the transport and residential sectors
POSITIVE ENVIRONMENTAL IMPACT	
P&M57	Promotion of self-consumption
P&M58	Promotion of the search for new alternative energies in the Region
P&M59	Promotion of "intelligent energy" in all areas: multi-hybridization, local energy mix
P&M60	Promotion of the use of industrial and public transport vehicles with electric, hybrid or gas propulsion
P&M61	Dissemination actions on the impact on ecosystems of saving CO2 emissions

P&M62	Training on energy and climate change
P&M63	Pilot experiences with media coverage of technologies that are already working and are viable
P&M64	Promote proximity between the workplace and the workers' homes
P&M65	Encourage the use of non-polluting modes of transport for workers on their journeys to work centres
P&M66	Promotion and optimization of biomass certification
P&M67	Promotion of energy advice to companies
P&M68	Dissemination campaign on energy recovery technologies and waste management
P&M69	Environmental and economic study for the use of biomass from existing forest masses and agricultural remains
P&M70	Environmental and economic study for the use of biomass from forest masses to be planted or crops
ADMINISTRATION AND SIMPLIFICATION	
P&M71	Coordination between Administrations in energy matters
P&M72	Strengthen representation in decision-making bodies
P&M73	Study of energy-intensive industries
P&M74	Mapping of energy-intensive industries and infrastructures
P&M75	Legislate tax exemptions for investment in energy efficiency
P&M76	Promotion of R+D+i in the field of energy
P&M77	Promotion of simplification in the processing of renewable energy installations and actions in terms of energy efficiency
P&M78	Establishment of a certification and qualification system for installers
P&M79	Optimization of contracting times for energy supplies
P&M80	Regulations on emission limits for renewable energy installations
Actuation areas	Region of Murcia
Additional relevant information	-

11.7.6. Annex 4.6. Deep analysis of document #16 of CS4

Table 104. Document #16 of CS4 Murcia Region deeply analysed

Case Study	**CS4 – Mediterranean Region Murcia Region (ES)**		
#16	**Special Civil Protection Plan against the Risk of Flooding in the Autonomous Community of the Region of Murcia** | *(ES: Plan Especial de Protección Civil ante el Riesgo de Inundaciones de la Comunidad Autónoma de la Región de Murcia – INUMMUR)*		
Type of document	Plan	**Language(s)**	Spanish
Scope	Sectoral	**Year of adoption**	2007
Web link	https://conocimientoabierto.carm.es/jspui/handle/20.500.11914/2127	**Target year**	-
Brief description	The plan's aim is to establish the organization and action procedures of the public resources and services that intervene in an emergency due to the risk of flooding in the Region of Murcia. For the purpose of this Plan, it is considered: all those emergencies due to flooding from significant rainfall, breakage or breakdown of dams, or due to extraordinary flooding in any part of the channels that drain the regional		

	space or that could affect it, as well as due to any other cause of flooding that represents a risk to the population and their property.
Sectors involved	Water and waste
Main target addressed (#1)	**FUNDAMENTALS FOR CIVIL PROTECTION AGAINST THE RISK OF FLOODING**
Other relevant objectives or strategies addressed	
O1	**Territorial information**: Location, orography and relief, orological and morphological characteristics, climate, land uses, environmental zones, hydrographic network, hydraulic infrastructures, networks and observation points, communication infrastructures, population.
O2	**Historic floods**: Methodology applied to risk analysis, analysis and classification of flood zones (floods caused by precipitation in situ, affected population, results by area, municipalities with high risk).
Main target addressed (#2)	**STRUCTURE AND ORGANISATION OF THE PLAN**
Other relevant objectives or strategies addressed	
O3	**EMERGENCY PHASES: Pre-emergence phase**
Relevant policies and measures included	
P&M1	Alert derived from meteorological warning
P&M2	Rainwater monitoring
Other relevant objectives or strategies addressed	
O4	**EMERGENCY PHASES: Emergence phase**
Relevant policies and measures included	
P&M3	**Level 0**: situations in which the meteorological and/or hydrological data make it possible to foresee the imminence of floods, with danger to people and goods or those in which the flood could have occurred, even if very localized, affecting a single term municipal and can be resolved by the municipal media and/or by the media of the Autonomous Community attached to the Municipal Plan.
P&M4	**Level 1**: situation in which either floods have occurred that affect more than one municipal term, or, due to their level of severity or scope, they require the intervention of the resources of the Autonomous Community not attached to the Municipal Plan.
P&M5	**Level 2**: situation in which floods have occurred in which, due to their severity, it is expected that, at the request of the Plan Directorate, state resources not assigned to the Plan will be incorporated, or the pluviometry and hydrological data and the meteorological forecasts allow an extension or aggravation of the situation that could lead to the national interest. Likewise, those emergencies defined as Scenarios 2 and 3 in the Dam Emergency Plan, will be declared as level 2, unless due to their consequence it is considered to be of national interest.
P&M6	**Level 3**: emergencies that, having considered that the national interest is at stake, are declared by the Minister of the Interior, in accordance with the assumptions established in the Basic Regulation. In this situation, the direction of the Plan will correspond to the person designated by the Minister of the Interior.
Other relevant objectives or strategies addressed	
O5	**EMERGENCY PHASES: Normalization phase**
Relevant policies and measures included	
P&M7	Consecutive phase to the emergency phase, which lasts until the reestablishment of the minimum essential conditions for a return to normality in the areas affected by the flood.
P&M8	First rehabilitation tasks are carried out in said areas, consisting mainly of inspecting the state of buildings, cleaning homes and urban roads, repairing the most significant damage, and rehabilitating fundamental basic services.
Other relevant objectives or strategies addressed	

O6	**OVERALL STRUCTURE OF THE PLAN**
Relevant policies and measures included	
P&M9	Management of the plan, Advisory committee, Information cabinet, Chief of operations, Flood assessment group, Operational coordination centre (CECOP), CECOP coordinators, Advanced command post, Action groups.
Main target addressed (#3)	**OPERABILITY**
Other relevant objectives or strategies addressed	
O7	**Situation assessment**: Forecasting and monitoring of meteorological phenomena (area of application; values, thresholds and warning levels; notice bulletins); Pluvio-hydrological monitoring; Warning system of the state of dams and reservoirs.
O8	**Plan activation**
O9	**Actions in the pre-emergency phase**
O10	**Actions in the emergency phase**
O11	**Actions in the normalization phase**
O12	**Actions in action groups**: Intervention groups, Damage assessment groups, Essential services restoration group, Health group, Order group, Logistics support group, Social action group.
Main target addressed (#4)	**DAM EMERGENCY PLANS**
Other relevant objectives or strategies addressed	
O13	**Basic functions**
O14	**Classification of dams according to the potential risk**
O15	**Dams that must have an emergency plan**
O16	**Minimum content**: Dam safety analysis, Territorial zoning and analysis of the risks generated by the breakage of the dam, Rules of action, Organization, Media and resources,
O17	**Elaboration and approval of the dam emergency plan**
O18	**Safety scenario and danger of dam breaking**
O19	**Inter-phase between the emergency plan of the dam and the special plan against the risk of flooding**
Main target addressed (#5)	**LOCAL EMERGENCY PLANS**
Other relevant objectives or strategies addressed	
O20	**Municipalities with the obligation to prepare a local action plan**, including administrative and geographic data, hydraulic data, affected population, risk level.
O21	**Functions**: Provide the organisational structure and the procedures for intervention in emergencies due to floods; Catalogue vulnerable elements and zone the territory according to risk; Catalogue reservoirs and irrigation ponds whose rupture or overflow could endanger the lives of people and their property; Specify information and alert procedures for the population; Have an updated list of the specific means and resources (both public and private) necessary for the implementation of the planned activities.
O22	**Minimum content**: Risk analysis; Analysis of the consequences (high, medium and low risk areas); Structure and organization of the Plan; Operation and implementation of the plan; Implementation and maintenance of operation; Annexes.
O23	**Actions to be considered in the Plans**: Provide information on the evolution of rainfall episode and the hydrological parameters in the riverbeds of the municipality; Prevent parking or camping in dry riverbeds, river banks, gullies, etc. Special attention to campsites located in risk areas; Control and/or signpost flood-prone sections of highways,

	especially intersections with riverbeds; Monitor the evolution of the water level in the channels; Exchange information with the municipalities of their basin and with the CECARM; Inform the population in risks situations.
O24	**Municipal coordination centre (CECOPAL)**
O25	**Interrelation of the local action plans and the special plan for flooding in the Region of Murcia**
Main target addressed (#6)	**IMPLEMENTATION AND MAINTENANCE OF THE ACTION PLAN**
Other relevant objectives or strategies addressed	
O26	**Implantation**: Specify the necessary infrastructure of trained human and material resources to deal with emergencies caused by floods and determine the systems for locating the responsible ones; Establish the necessary protocols, conventions and agreements with the different participating agencies and entities, to clarify actions, and for the allocation of means and/or Technical Advice; Preparation by each responsible entity of the Action Plans of the Action Groups and of the municipal action plans. It includes also the **divulgation of the Plan**, as well as to **inform the population**.
O27	**Maintenance of operation**: Update-Revision; Programme of exercises and simulations.
Main target addressed (#7)	**CATALOGUE OF MEDIA AND RESOURCES**
Other relevant objectives or strategies addressed	
O28	**Databases where all information** about possible media and resources to mobilize phasing emergencies produced by floods is gathered.
Actuation areas	Region of Murcia
Additional relevant information	-

11.7.7. Annex 4.7. Deep analysis of document #17 of CS4

Table 105. Document #17 of CS4 Murcia Region deeply analysed

Case Study	**CS4 – Mediterranean Region Murcia Region (ES)**		
#17	**Emergency Civil Protection Plan for Forest Fires in the Region of Murcia** | *(ES: Plan de Protección Civil de Emergencia por Incendios Forestales en la Región de Murcia - INFOMUR)*		
Type of document	Plan	**Language(s)**	Spanish
Scope	Sectoral	**Year of adoption**	2021
Web link	https://conocimientoabierto.carm.es/jspui/handle/20.500.11914/2103	**Target year**	-
Brief description	The main objective is to establish the hierarchical and functional organization, as well as the procedures for action of the resources and services whose ownership corresponds to the Autonomous Community of Murcia; in order to protect people, property and the environment in the event of fires forest.		
Sectors involved	Agriculture, forestry and fishing		
Main target addressed (#1)	**TERRITORIAL INFORMATION**		
Other relevant objectives or strategies addressed			
O1	**Orography**: description of the Murcia Region, area, morphology, reliefs (from the Bética, Subbética and Prebética formations), valleys, main river (Segura) and reservoirs.		

O2	**Climatology**: typically Mediterranean climate, with hot and dry summers, mild winters and equinoctial rains. In general of a marked irregularity.
O3	**Vegetation**: description of forest area, evolution of the forest mass, distribution of forest use in the Region of Murcia (grassland, scrubland, tree forest species).
O4	**Forest shires (regions)**: Plateau, West coast, Centre-east, Centre, Northwest.
Main target addressed (#2)	**RISK AND VULNERABILITY ASSESSMENT, TERRITORIAL ZONING AND TIMES OF DANGER**
Other relevant objectives or strategies addressed	
O5	**WILDFIRE HAZARD ANALYSIS**
Relevant policies and measures included	
P&M1	**Risk index**, calculated based on the estimation of the Local Risk Index, referring to each one of the municipalities taking into account its orography, climatology, the surface and density of its forest mass, whether it is wooded or scrub, and fundamentally the number of fires that occurred in the last years.
P&M2	**Methodology used to assess risk index**, mainly influenced by the characteristics of the existing forest fuel in the forest, the probability that any of the typical causes of fire and the meteorological conditions of each moment occur. Forest fire risk is defined as the probability of a fire occurring in an area. It is estimated through three indices that reflect the frequency of fires, the dangerousness of the causes and the dangerousness of the fuels.
P&M3	**Vulnerability**, certain forest territories in the Region: Protected Natural Spaces, Places of Community Importance, Special Protection Areas for Birds, Public Forests, Fauna Protection Areas, Protected Species of Flora and Fauna, Ecological Sensitivity Areas, Regional Hunting Reserves, Hunting Reserves, Wildlife Refuges Hunting, Recreational Areas, and Tourist and Public Use facilities where human pressure is great, affecting Vulnerability and, of course, defence priority.
Other relevant objectives or strategies addressed	
O6	**TERRITORIAL ZONING**
Relevant policies and measures included	
P&M4	High risk areas (definition of municipal terms)
P&M5	Medium risk areas (definition of municipal terms)
P&M6	Low or zero risk areas (definition of municipal terms)
P&M7	ZAR (High Risk Zones), areas in which the frequency or virulence of forest fires, and the importance of the threatened values make special fire protection measures necessary.
P&M8	Distribution of fuel by region
P&M9	Map of intervention areas
Other relevant objectives or strategies addressed	
O7	**TIMES OF DANGER**
Relevant policies and measures included	
P&M10	Time of high danger, between 1st June and 30th September
P&M11	Time of medium danger, between 1st April and 31st May & from 1st to 31st October
P&M12	Time of low danger, between 1st November and 31st March
Main target addressed (#3)	**POTENTIAL SEVERITY RATE OF FIRES**
Other relevant objectives or strategies addressed	

O8	A **potential severity index calculation matrix** will be used so that the determination of this index can be comparable to that of other territories. The aforementioned **classification** will be made based on the topographic conditions of the area where the fire or simultaneous fires develop, the extension and characteristics of the forest masses that are threatened, the conditions of the physical environment and infrastructures, the prevailing meteorological conditions, as well as possible dangers for people not related to the extinction work and for facilities, buildings and infrastructures. Likewise, the human and material resources necessary to deal with extinction will be evaluated and they will be interrelated with the truly available troops.
Main target addressed (#4)	**OPERATING SITUATION**
Other relevant objectives or strategies addressed	
O9	Taking into account **criteria** such as the temporal simultaneity and/or spatial concentration of attempts or fires; the sufficiency, sustainability and availability of the means and resources available to the plan for the control of the fire and/or for the care and relief of the affected population; temporal seasonality as well as the activation and commissioning of forest fire prevention and extinction devices; other circumstances of an administrative nature due to the territorial space affected; any other. Definition of **Situations 0, 1, 2 and 3.**
Main target addressed (#5)	**STRUCTURE AND ORGANIZATION OF THE PLAN, definition of functions of each responsible**
Other relevant objectives or strategies addressed	
O10	**Direction and coordination**
O11	**Advisory committee**
O12	**Information office**
O13	**Operations manager**
O14	**Forest coordinator**
O15	**Fire coordinator**
O16	**Base area coordinator**
O17	**Director of extinction**
O18	**Action groups**: detection and warning group, extinction group, health group, logistics group, social action group, order group, cause investigation group, extraordinary means
Main target addressed (#6)	**OPERABILITY**
Other relevant objectives or strategies addressed	
O19	**Emergency phases**: pre-emergency phase and emergency phase
O20	**Activation of the plan**: notice rules and activation procedure
O21	**Time of high danger**
O22	**Time of medium danger**
O23	**Time of low danger**
O24	**Operation in large fires**
O25	**Integration into the INFOMUR plan of the Local Action Plans**
O26	**Actions to support neighbouring autonomous communities**
Main target addressed (#7)	**PLAN MAINTENANCE**

Other relevant objectives or strategies addressed	
O27	Divulgation
O28	Operating procedures
O29	Training and updating of active personnel
O30	Resources and media update
Actuation areas	Region of Murcia
Additional relevant information	-

11.7.8. Annex 4.8. Deep analysis of document #19 of CS4

Table 106. Document #19 of CS4 Murcia Region deeply analysed

Case Study	CS4 – Mediterranean Region Murcia Region (ES)		
#19	**Strategic Plan for the Agrifood Sector of the Region of Murcia** | *(ES: Plan Estratégico del Sector Agroalimentario de la Región de Murcia)*		
Type of document	Plan	Language(s)	Spanish
Scope	Sectoral	Year of adoption	2007
Web link	https://www.carm.es/web/pagina?IDCONTENIDO=4582&IDTIPO=100&RASTRO=c80$m22721,22746	Target year	-
Brief description	It deeps and determines the appropriate strategies to deal with the external and internal environment of the agrifood sector in Murcia, that affect the profitability of their companies, to deal with them successfully and improve the competitiveness of the sector.		
Sectors involved	Agriculture, forestry and fishing	Industry and commerce	
Main target addressed (#1)	PRODUCTION STRATEGIC OBJECTIVE		
Other relevant objectives or strategies addressed			
O1	**Improve the structure and modernization of existing farms**, through resizing, generational replacement, professional training, modernization, environmental protection and energy saving		
Relevant policies and measures included			
P&M1	Support for generational change through aid for the installation of young farmers		
P&M2	Support for early cessation of agricultural activity for farm owners over 55 years of age linked to the incorporation of young people		
P&M3	Improvement of the professional qualification of the owners of the agricultural exploitations and of the professionals of the sector through regulated training, and attendance at courses, seminars and training stays		
P&M4	Support for the incorporation of farmers into existing agricultural cooperatives and for their participation in management		
P&M5	Support for farmers in the main through positive discrimination of different aids		
P&M6	Encourage the voluntary re-parcelling of land from small farms, through land exchanges (speed up procedures and reduce fees)		
P&M7	Support for joint production		
P&M8	Support for the creation of land banks within associative entities		

P&M9	Support for the technological improvement of farms and promotion of the machinery renewal plan
Other relevant objectives or strategies addressed	
O2	**Reduce the costs** derived from water, environmental, energy and insurance; **and optimize investments**
Relevant policies and measures included	
P&M10	Analysis of critical points in companies
P&M11	Maximize the use of existing infrastructures, through agreements to amortize those that are only used for short periods of time
P&M12	Reduce the costs derived from the scarcity and poor quality of water
P&M13	Reduce production assurance costs
P&M14	Reduce environmental costs
P&M15	Reduce energy costs
Other relevant objectives or strategies addressed	
O3	**Promote coordination/integration between agricultural production and the agrifood industry**
Relevant policies and measures included	
P&M16	Promotion of supply agreements between agricultural companies and the agrifood industry, giving priority to standard contracts
P&M17	Support for the establishment of strategic alliances between the agricultural company and the agrifood industry (collaboration agreements, etc.)
Other relevant objectives or strategies addressed	
O4	**Obtain products adapted to the demands of the market**, in terms of variety, quantity and quality, with special attention to the development and promotion of organic farming
Relevant policies and measures included	
P&M18	Support for experimentation with new crops and varieties
P&M19	Support for the introduction of new crops and varieties
P&M20	Support for varietal conversion (vineyards, fruit trees, etc.)
P&M21	Support for the implementation of new production systems (ecological agriculture, controlled production, clean agriculture and livestock, etc.)
P&M22	Demand traceability and improve management systems
Other relevant objectives or strategies addressed	
O5	**Improve the health status of farms through good agricultural practices**
Relevant policies and measures included	
P&M23	Creating an ATRIAS record (Groups for Integrated Treatments in Agriculture)
P&M24	Support to the Groups for Integrated Treatments in Agriculture (ATRIAS)
P&M25	Support for the revitalization of the ADV (Plant Defense Groups)
P&M26	Promotion of Comprehensive Plans to Fight Pests and Diseases
P&M27	Aid for the uprooting of fruit trees affected by certain viral diseases
Other relevant objectives or strategies addressed	

O6	**Support the income of exploitation holders (farm owners) with competitiveness problems**
Relevant policies and measures included	
P&M28	Compensatory aid for arable crop producers
P&M29	Income aid for nut growers
P&M30	Aid for the cultivation of energy products
P&M31	Aid for the conversion of subsectors in crisis
Other relevant objectives or strategies addressed	
O7	**Improve the degree of insurance of farms**
Relevant policies and measures included	
P&M32	Promote the dissemination and adaptation of agricultural insurance to the real needs of the sector, improving the conditions of any line of insurance
P&M33	Aid for advice and contracting of agricultural insurance
Other relevant objectives or strategies addressed	
O8	**Promote the recovery of native varieties**
Relevant policies and measures included	
P&M34	Aid for the promotion of the cultivation of autochthonous varieties
Other relevant objectives or strategies addressed	
O9	**Promote the breeding of native cattle breeds**
Relevant policies and measures included	
P&M35	Aid for the promotion of autochthonous cattle breeds (Designation of Origin, promotion, etc.) as viable farms
Other relevant objectives or strategies addressed	
O10	**Recover the breeding of endangered breeds**
Relevant policies and measures included	
P&M36	Aid for the recovery of cattle breeds in danger of extinction of a social nature
Other relevant objectives or strategies addressed	
O11	**Improve the health status of livestock farms**
Relevant policies and measures included	
P&M37	Creating an ADS record (Health Defense Groups)
P&M38	Support to Health Defense Groups (ADS)
P&M39	Promotion of programs for the eradication of infectious-contagious diseases
Other relevant objectives or strategies addressed	
O12	**Modernize the fishing fleet**
Relevant policies and measures included	
P&M40	Aid for the modernization of fishing vessels to improve safety on board, working conditions and handling of products on board
Other relevant objectives or strategies addressed	

O13	**Modernize existing aquaculture facilities**
Relevant policies and measures included	
P&M41	Aid for the modernization of aquaculture facilities in environmental matters
Other relevant objectives or strategies addressed	
O14	**Improve the health status of aquaculture facilities**
Relevant policies and measures included	
P&M42	Sanitary plan for the eradication of pathological risks in aquaculture
Other relevant objectives or strategies addressed	
O15	**Reduce the environmental impact of agricultural and fishing activity**
Relevant policies and measures included	
P&M43	Aid for the collection and treatment of water from agricultural crops
P&M44	Aid for the collection and treatment of polluting waste (animals and fish, plastics, packaging, etc.)
P&M45	Aid for the environmental adaptation of livestock farms
P&M46	Helps in the management of by-products of plant and animal origin
Main target addressed (#2)	**TRANSFORMATION STRATEGIC OBJECTIVE**
Other relevant objectives or strategies addressed	
O16	**Improve the productive efficiency of transformation plants**
Relevant policies and measures included	
P&M47	Modernization of facilities by incorporating technical innovations in facilities, equipment and processes (new technologies, etc.)
P&M48	Transfer of facilities from urban centres to prepared industrial estates/or to land authorized by the competent authority
P&M49	Reduce energy costs
Other relevant objectives or strategies addressed	
O17	**Improve the size and structure of transformation companies**
Relevant policies and measures included	
P&M50	Promote the transformation of regional products to achieve greater added value
P&M51	Support the achievement of more adequate production-transformation business scales
P&M52	Support the improvement of the management and administration of agrifood companies
P&M53	Business concentration and integration (vertical and horizontal)
P&M54	Promote productive, commercial and R+D+i collaboration actions between companies
P&M55	Promotion of mergers between companies
P&M56	Promote the search for opportunities, for smaller companies, in traditional, quality products, innovative formats, growing consumer segments, etc.
Other relevant objectives or strategies addressed	
O18	**Strengthen quality systems in the transformation sector**

Relevant policies and measures included	
P&M57	Promotion of quality products covered by Denomination of Origin, ecological or integrated
P&M58	Promotion of quality in all areas of the processing company: products, management, environment, etc.
Other relevant objectives or strategies addressed	
O19	**Strengthen efforts in R+D+i**
Relevant policies and measures included	
P&M59	Support for the implementation of innovation management systems in companies
P&M60	Promotion of R+D+i in new production processes and with new systems
Other relevant objectives or strategies addressed	
O20	**Promote coordination/integration between the agrifood industry and distribution**
Relevant policies and measures included	
P&M61	Promotion of supply agreements between the agrifood industry and distribution companies
P&M62	Support for the establishment of strategic alliances between the agrifood industry and distribution companies (collaboration agreements, cross-shareholdings, etc.).
Other relevant objectives or strategies addressed	
O21	**Support the launch and development of new products**
Relevant policies and measures included	
P&M63	Support for the innovation of products with higher added value
P&M64	Support for the launch of new products with greater added value (4th and 5th range, nutritional, dietary, etc.)
P&M65	Support for the implementation of new production systems (controlled and organic agriculture, clean agriculture, protocols, etc.)
P&M66	Improvement of automated traceability systems
Other relevant objectives or strategies addressed	
O22	**Promote the diversification of the agrifood and fishing industry**
Relevant policies and measures included	
P&M67	Promotion of productive diversification linked to new products and the use of by-products (pharmaceutical products, power generation, etc.)
Other relevant objectives or strategies addressed	
O23	**Improve the penetration of processed products in markets (internal and external)**
Relevant policies and measures included	
P&M68	Promotion of internationalization and strengthening of presence in markets
P&M69	Dissemination of studies on the perspectives of the different markets, products, competitors, consumption, legislation, etc.
Other relevant objectives or strategies addressed	
O24	**Follow the evolution of the competitive advantages (dynamics) of the transformer sector**
Relevant policies and measures included	

P&M70	Monitoring of the growth experienced by the different transformation activities and the identifiable strategic groups in each of them
Other relevant objectives or strategies addressed	
O25	**Improve sectoral coordination and concertation**
Relevant policies and measures included	
P&M71	Promotion of transparency and knowledge of the situation of the productive sector through the generation of information on the sector
P&M72	Improvement of the work of coordination and concertation between the different agents
Other relevant objectives or strategies addressed	
O26	**Reduce the environmental impact of the agrifood industry**
Relevant policies and measures included	
P&M73	Promote the treatment of water from the agrifood industry
P&M74	Promote the improvement of the collection and treatment of contaminating by-products and waste from the agrifood industry
Main target addressed (#3)	**WATER AND INFRASTRUCTURES STRATEGIC OBJECTIVE**
Other relevant objectives or strategies addressed	
O27	**Improve the use of water resources**
Relevant policies and measures included	
P&M75	Aid to Irrigation Communities for investments in irrigation infrastructures (distribution and control systems) leading to water savings
P&M76	Investments in infrastructures and irrigation modernization
P&M77	Technification of irrigation systems (localized irrigation, volumetric control of consumption, etc.)
P&M78	Improving the waterproofing and coverage of water distribution and storage systems
P&M79	Information, training and advice on techniques and management of irrigation water
Other relevant objectives or strategies addressed	
O28	**Guarantee access to quality water resources at acceptable prices, with special attention to under-resourced areas**
Relevant policies and measures included	
P&M80	Defense of the Tajo-Segura transfer
P&M81	Promotion of purification and reuse of wastewater for agricultural use
P&M82	Promotion of the desalination of brackish and sea waters
P&M83	Implementation of drainage networks and water treatment and reuse
P&M84	Promotion of the interconnection of basins (transfers)
P&M85	Promoting the acquisition of water rights
P&M86	Help users and managers of poor quality water to reduce its negative effects
P&M87	Strengthen institutional cooperation on water issues
Other relevant objectives or strategies addressed	

O29	**Access relevant information for obtaining and managing water resources**
Relevant policies and measures included	
P&M88	Updating and improvement of the information on the real demand for irrigation water and its distribution according to Technical Economic Guidelines (OTEs)
P&M89	Updating and improvement of the information on the necessary infrastructures for the external supply of water
P&M90	Updating and improvement of water demand forecasts for agricultural use with medium-term time horizons
P&M91	Updating and improvement of the information on the ability to pay for water according to Technical Economic Guidelines (OTEs) and scenarios of evolution of the markets and the CAP
Other relevant objectives or strategies addressed	
O30	**Improve the image of Murcia in relation to the efficient use of water**
Relevant policies and measures included	
P&M92	Promote communication actions to publicize the efficient use of water that is made in the Region in general and, especially, in agricultural activity
Other relevant objectives or strategies addressed	
O31	**Promote education, awareness and training in water resources management**
Relevant policies and measures included	
P&M93	Carry out public awareness campaigns on saving water (Regional Program for Education in Water Conservation) and on inter-basin solidarity
P&M94	Support for specific training in water resources management
Other relevant objectives or strategies addressed	
O32	**Promote R+D+i in the use of water resources**
Relevant policies and measures included	
P&M95	Promote R+D+i related to the efficient use of irrigation water
P&M96	Creation of the R&D Centre for the efficient use of water linked to current research centres
Other relevant objectives or strategies addressed	
O33	**Improve road and transport infrastructure**
Relevant policies and measures included	
P&M97	Promotion of the Regional Plan for rural roads
P&M98	Promotion of road transport
P&M99	Promotion of the construction of the new international airport in the Region of Murcia
P&M100	Promotion of the construction of high-speed railway lines
P&M101	Promotion of the expansion and modernization of the port of Cartagena
Other relevant objectives or strategies addressed	
O34	**Improve energy infrastructures (electricity, natural gas, etc.)**
Relevant policies and measures included	
P&M102	Aid for farm access to the electricity grid
P&M103	Facilitate farm access to the natural gas network

Other relevant objectives or strategies addressed	
O35	**Improve access to new information and communication technologies**
Relevant policies and measures included	
P&M104	Aid for the implementation of new technologies (computers, automated irrigation systems, ...) by agricultural companies
P&M105	Facilitate Internet access for agricultural companies
Other relevant objectives or strategies addressed	
O36	**Arrange industrial land for the location and transfer of agrifood industries**
Relevant policies and measures included	
P&M105	Promote the promotion of industrial land for the agrifood industry
Other relevant objectives or strategies addressed	
O37	**Improve equipment in fishing ports**
Relevant policies and measures included	
P&M107	Improvement of unloading, transformation and storage conditions in ports
P&M108	Improved supply of fuel, ice, water and electricity
P&M109	Upgrading of ship maintenance or repair equipment
P&M110	Conditioning of the docks to improve safety conditions at the time of loading or unloading of products as well as environmental conditions
P&M111	Computerized management of fishing activity
Actuation areas	Region of Murcia
Additional relevant information	-

11.8. Annex 8. Case Study 4 – Mediterranean Region (Murcia): PESTLE results for the local ecosystem drivers' analysis

The Murcia Case Study did realize the three PESTLE activities. The first one took place during the physical consortium meeting in Sitia, where the inputs of that can be seen in following Figure 208. In that exercise, the PESTLE was done in a broader way, not only to consider the drivers (as positive things already in place) also including challenges, which serve as basis for the goal definition in the last exercise from this PESTLE activity.

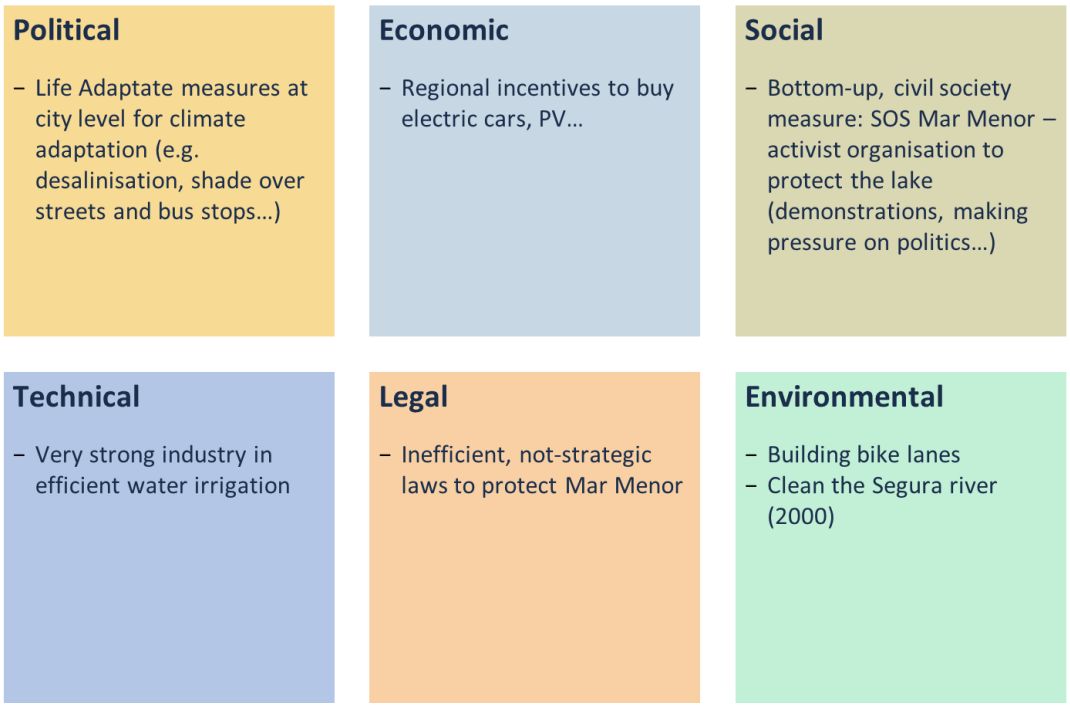

Figure 208. Murcia PESTLE analysis of local ecosystem drivers (activity during Sitia project meeting)

Then, contrast exercise was performed by the Local Council of Stakeholders, from which the following outcomes (Table 107) were obtained. As the Local Council of stakeholders from Murcia Region CS is formed up so far by different municipalities that are engaged to received support and information (and data) from the NEVERMORE project to be able to elaborate and submit the SECAP (mainly the adaptation part of it) to the Covenant of Mayors, the drivers on this PESTLE analysis are mainly at those municipal levels.

Table 107. Murcia PESTLE analysis of local ecosystem drivers – input from Local Council Stakeholders

Murcia CS POLITICAL local drivers
Urban plan that increases the green area and bio-sustainable movements
Local authorities willing to the implementation of non-disturbing activities and ecotourism
Political context in favour of carrying out actions aimed at fighting climate change
Powerful business ecosystem and climate conditions that favour the development of photovoltaic solar energy in self-consumption modality
Regional Strategy for Mitigation and Adaptation to Climate Change, with specific guidelines on how to update local policies to climate ambition
Sustainable Master Plan of Villa de Fuente Álamo Master Plan, with objective: to raise awareness on the importance of sustainability
Urban Agenda 2030
Urban City Plans

Region of Murcia Strategy on mitigation and adaptation to climate change to 2021 and the 15 guiding principles it includes
Urban Plan that promotes the development of new infrastructures
Murcia CS ECONOMIC local drivers
Attempt to approach local companies to boost the economy
Active promotion of local green employment in the region
Incipient local green taxation
High investment in photovoltaic solar energy, both in large plants and self-consumption
Primary sector that is beginning to become aware of its impact on ecosystems and climate
Sustainable Master Plan of Villa de Fuente Álamo
Patronage
Promotion of circular economy
In the absence of actual financing from the Autonomous Region of Murcia (just a line with barely 80.000€ launched in December 2022 for unique projects on mitigation or adaptation) municipalities look at the FEDER lines of the central state administration: lines such as EDUSI are the ones at what municipalities look when applying for financing for actions linked to climate resilience
Local actors investing in renewable energy systems
Murcia CS SOCIAL local drivers
Public Authorities that generates awareness and promote actions against climate change
Development of the employment and training program for “Auxiliary activities in forest conservation and improvement”
Local NGO that promotes the efficient use of resources by raising public awareness
Sustainable Master Plan of Villa de Fuente Álamo
Increasing population awareness
Hippocampus association for the sea conservation in Murcia
Initiatives that promote healthy living, for example zero-emission transport
City Council, local institutions
Murcia CS TECHNICAL local drivers
Increased efficient automation of outdated parameters (e.g., irrigation systems)
Installation of charging point for electric vehicles
5K project
ICT (information and communication technologies) solutions implemented at local level (for example, 5G networks)
Presence of three universities, one of them polytechnic
Network of technology centers
Plans that promote technological research
Scarce participation of actors from the Murcia region in calls related to technology, R&D from the EU: these news or calls are provided as part of the task maintained over time to inform all municipalities in the Murcia region affiliated to the Covenant of Mayors on these EU calls, but the level of participation is very low
Local actors focused on R&I (research and innovation) activities on climate change adaptation and mitigation
Murcia CS LEGAL local drivers
Executed action plan of the Mar Menor Law
Good agricultural practices
Law on Integrated Environmental Protection
Protected areas with a specific legal framework within the territory
Climate Emergency Declaration approved on June 4, 2020
Order of June 28, 2021, the Ministry of Water, Agriculture, Livestock, Fisheries and Environment, approved the voluntary agreement to achieve climate neutrality in the business sphere
Regional Strategy for Mitigation and Adaptation to Climate Change
Municipal equality plan

Regional Park of the salts and falts of San Pedro del Pinatar
Legislation regulating rural housing
Current legislation for gender equality and non-discrimination
Murcia CS ENVIRONMENTAL local drivers
Increase energy efficiency (solar panels), project to increase green area and increase shade
Ojos Naturalized Viewpoint Project, drawn up with criteria for the use of Nature-based Solutions, through the adaptation of sustainable urban drainage systems (SUDS), the organization of spaces, the planting of native trees and shrubs, so that the fabric and vegetation cover, the stay and neighbourhood cohesion are favoured and the accessibility of public spaces improved
Biogas plant construction project
Enhancement of Natural spaces, Majal de Gracia and formation of a green lung in the Old speed circuit of Fuente Álamo
Green areas protection plans
From the development agency we are encouraging two types of clients in three lines of action: - PUBLIC CLIENT: MUNICIPALITIES with the affiliation to the Covenant of Mayors for Climate and Energy - PRIVATE CLIENT: COMPANIES with 1) disclosure of the principles of environmental sustainability derived from Principle 13 of Climate Action of the SDGs of the UN Global Agreement, and 2) launch of a Business Plan for Climate and Energy, to which INFO Murcia is about to sign an association agreement with the entity that develops them for the European Commission
Project approved for the protection, conservation and subsequent development of a forest in the area, which will contribute to adaptation to climate change, improvement of air quality and other associated co-benefits
Comprehensive project to reduce vulnerability to the DANAS that occur in the area and the runoff that occurs in the riverside municipalities

All in all, final exercise gathering inputs and collective feedback around the different drivers around each aspect was done, with a prior reflection on the case study vulnerable sectors, challenges and goals to overcome those challenges (Table 108), in order to set the basis for the final brainstorm on local drivers that can facilitate or enable the design and deployment of different policies at the case study.

Table 108. Murcia CS analysis of challenges and goals related to CS vulnerable sectors to serve as basis for the PESTLE analysis of local ecosystem drivers

MURCIA VULNERABLE SECTORS
Agriculture, forestry and fishing
Water and waste
Tourism, leisure and cultural heritage
Industry and commerce
CHALLENGES (mainly related with the vulnerable sectors)
Limited water resources (low rainfall)
Increasingly frequent intense rainfall (DANA, gota fría)
Desertification (soil erosion) - Advance of the desert > loss of productive zone
Critical infrastructures and urban spaces affected
Health impact of flooded community
Unsustainable water management - efforts already in place, but enough?
Threatened coast line (sea level rise)
Heat waves
Bad agricultural practices
Expansions of lands used for agriculture (irrigated)
Highly emitting industries (diffuse sectors)
Soil with few nutrients
Biodiversity loss

GOALS (to overcome the challenges)
Desalination plants, for human consumption and agriculture + reuse of water at building level + separation of water (irrigation and drinking supply networks) at city level
Promote permeabilization of urban land with SUDS (Sustainable Urban Drainage Systems) + Urban gardens
Fight against the loss of productive land due to the advance of the desert
Increase infrastructure adapted to CC
More effective society awareness
Optimisation of water resources to ensure the water supply (to population and agriculture)
Strategic laws to protect Mar Menor
Energy efficiency improvement in buildings + Bioclimatic architecture
Promote crops of species better adapted to CC
More advanced agriculture water management techniques, hydroponics, drip irrigation
Low carbon economy
Promote biodiversity (also through NbS)
Nature-based solutions promotion

Following Table 109 concludes with the final outcomes of the PESTLE analysis performed for the Murcia case study, considering also all previous inputs from the other activities as well as the basis of the vulnerable sectors, challenges and goals.

Table 109. PESTLE analysis of local drivers of Murcia Case Study (final activity)

POLITICAL MURCIA CS local drivers	*Secondary aspect*
Life Adaptate measures at city level for climate adaptation (e.g., desalinisation, shade over streets and bus stops...)	
ECONOMIC MURCIA CS local drivers	***Secondary aspect***
Economic invectives for industry to calculate the CO_2 and water footprint	*ENVIRONMENTAL*
Sustainability voucher: external service to calculate it and get the ISO certificate	*ENVIRONMENTAL*
Regional incentives to buy electric cars, PV...	
SOCIAL MURCIA CS local drivers	***Secondary aspect***
Society awareness on climate change	
Sustainable transport promotion	*TECHNICAL*
Sustainable tourism promotion	
Promotion of energy efficiency	*TECHNICAL*
Public awareness	
SOS Mar Menor: activist organisation to protect the lake (demonstrations, making pressure on politics...)	*ENVIRONMENTAL*
TECHNICAL MURCIA CS local drivers	***Secondary aspect***
More advanced agriculture water management techniques: hydroponics, drip irrigation	
Access to data and information about climate change from the competent environmental authority	
Data for every energy source and use	
In the past, INFO Murcia used to share reports about energy consumption data with municipalities	
Municipalities trust on data, reports and support from INFO Murcia	
ADAPTECCA national website for reference on climate change scenarios, vulnerabilities...	
Very strong industry in efficient water irrigation	
LEGAL MURCIA CS local drivers	***Secondary aspect***
Emission trading of diffuse sectors and industries	
Environmental impact declarations	
ENVIRONMENTAL MURCIA CS local drivers	***Secondary aspect***

Ecological green corridors	
Urban areas shadowing	
Public lighting LED (efficient)	
PV panels	
Biomass use promotion	*SOCIAL*
Urban gardens	*SOCIAL*
Avoid the use of nitrates in agriculture	
Fight against fires in forest in the region	
Fight against pollution of aquifers	
Effort to reduce the overexploitation of aquifers	
Reuse of grey water, reinjection after debugging	*TECHNICAL*
Desalination plants, for human consumption and for agriculture	*TECHNICAL*
Circular economy	*TECHNICAL*
Building bike lanes	
Clean the Segura river (2000)	

11.9. Annex 9. Case Study 5 – Wetland (Tulcea): Past experience and legal framework analysis

Table 110. Relevant documents identification of CS5 Danube Delta (all of them part of the deeper analysis)

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
1	**National strategy on adaptation to climate change for the period 2022-2030 in the perspective of 2050 (SNASC)**	Strategy	http://www.mmediu.ro/app/webroot/uploads/files/SNASC_SEA_2022.pdf	National	2022	• Energy • Cities and urban planning • Industry and commerce • Water and waste • Agriculture, forestry and fishing	The overall objective of SNASC is to improve the capacity to adapt and increase the resilience of socio-economic and natural systems to the effects of climate change, on different domains and time intervals. The strategy ensures continuity and coherence with the adaptation component of the "National Strategy on climate change and economic growth with low carbon dioxide emissions for the period 2016-2030". At the same time, the SNASC aims at sectoral development, in line with the principles of the new EU climate change adaptation strategy: smart, rapid, systemic and connected adaptation at the global scale of action.
2	**Romania's energy strategy 2022-2030, in the perspective of 2050**	Project	https://energie.gov.ro/wp-content/uploads/2022/08/Strategia-2030_DGJRI_AM_12.08.2022_MU_Clean_25.08.2022-1.pdf	National	2022	• Energy	The Energy Strategy proposes concrete objectives, establishes clear directions and defines the milestones by which Romania will maintain its position as an energy producer in the region and as an active and important actor in the management of stress situations at the regional level.
3	**Romania's national action plan in the field of energy efficiency**	Plan	https://energy.ec.europa.eu/system/files/2020-04/ro_final_necp_main_ro_0.pdf	National	2016	• Energy	Improving energy efficiency is one of the priority elements of Romania's energy strategy, considering the major contribution to achieving security of supply for consumers, ensuring sustainable development and competitiveness, saving energy resources and reducing greenhouse gas emissions.
4	**Romania's Strategy for Sustainable Development 2030**	Strategy	https://dezvoltaredurabila.gov.ro/files/public/10000001/Romania-Sustainable-Development-Strategy-2030-en.pdf	National	2018	• Biodiversity and natural heritage	Romania, as a member of the United Nations (UN) and the European Union (EU), has adopted the 2030 Agenda and its 17 Sustainable Development Goals. The 2030 Agenda was adopted at the United Nations Sustainable Development Summit though UN General Assembly resolution A/RES/70/1. The European Council endorsed this Agenda in "A Sustainable European Future: The EU Response to the 2030 Agenda for Sustainable Development" on 20 June 2017. The Council's document represents the political document to which the member states have committed themselves, setting the direction EU member states should follow in their task of implementing the

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
							2030 Agenda for Sustainable Development. Romania's Sustainable Development Strategy 2030 (hereafter referred to as the "Strategy") defines Romania's national framework for implementing the 2030 Agenda for Sustainable Development, providing a roadmap for achieving the 17 SDGs. This strategy promotes the sustainable development of Romania by focusing on Sustainable Development's three dimensions: economic, social, and environmental. This strategy is citizen-centred and focuses on innovation, optimism, resilience, and the belief that the role of the state is to serve the needs of each citizen in a fair, efficient, and balanced manner, all within a clean environment.
5	**The integrated strategy for sustainable development of the Danube Delta**	Strategy	https://www.mdlpa.ro/userfiles/delta_dunarii/rezultate_proiecte/4_Raport_Strategie_en.pdf	Local	2016 (& 2020)	• Agriculture, forestry and fishing • Biodiversity and natural heritage • Cities and urban planning	The strategy ensures the balance between protecting the unique natural heritage of the Danube Delta Biosphere Reserve (RBDD) and socio-economic development meeting the aspirations of the area's inhabitants by improving living conditions, creating better economic opportunities and an adequate capitalization of the natural and cultural heritage.
6	**National disaster risk management plan**	Policy	https://igsu.ro/Resources/COJ/ProgrameStrategii/pdf24_merged.pdf	National	2020	• Cities and urban planning	The systematic, unitary and inter-institutional approach to the measures and actions necessary to be implemented to ensure prevention, preparation and adequate response, at system level, in accordance with international guidelines and with Romania's obligations arising from the status of a member state of the European Union and the UN on disaster risk reduction.
7	**The national strategy regarding social inclusion and poverty reduction for the period 2022—2027**	Strategy	https://mfamilie.gov.ro/1/wp-content/uploads/2022/08/Anexa_HG_440_2022_MO_Partea_I_359Bis.pdf	National	2022	• Society	The national strategy regarding social inclusion and poverty reduction for the period 2022-2027, hereinafter referred to as the Strategy, represents a catalytic factor of the efforts and commitment of the Government of Romania assumed for the sustainable development of Romania in the 2030 horizon and, at the same time, for ensuring a fair, dignified and prosperous life to its inhabitants, providing the general intervention framework for achieving social cohesion and combating the complex challenges generated by poverty and social exclusion and accentuated by the economic crisis seen in the context of the SARS-CoV-2 pandemic, paying special attention to the inclusion of vulnerable groups.

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
8	**Climate change and environmental education in sustainable schools**	Other	https://www.presidency.ro/ro/media/clima-si-sustenabilitate/raportul-educatia-privind-schimbarile-climatice-si-mediul-in-scoli-sustenabile	National	2022	• Society	This report is a continuation of the Project "Educated Romania", initiated by the President of Romania, Klaus Iohannis, whose operationalization was included as a commitment in the National Defense Strategy for the period 2020-2024, and the strategic objectives and targets of the Project were assumed by the Government of Romania through the Memorandum.
9	**The strategy for the consolidation and development of the General Inspectorate for Emergency Situations for the period 2016-2025**	Law	https://legislatie.just.ro/Public/DetaliiDocumentAfis/184895	National	2016	• Society	The fundamental objective: Consolidation and development of the IGSU in order to increase the operational and response capacity, reduce the impact of the effects of emergency situations on the communities and improve the quality of the missions executed for the benefit of the population. In the field of emergency situations, Romania was affected by risks whose scale, intensity, frequency and mode of manifestation generated an important negative impact on social and economic development, requiring the allocation of substantial material, human and financial resources to restore normality. The manifestation of risks required a sequential study of them (an integrated analysis is being carried out through the National Disaster Risk Assessment Project - RO-RISK) which allowed the identification of 9 risks, grouped into 4 categories, with the following characteristics, each of them related to climate change effects: • fire risk: high frequency; affects important economic and social fields: constructions, installations, forests, means of transport, agricultural crops, etc.; • natural risks: repeatability, low predictability or unpredictability, with particular impact in terms of human and material losses; the need for complex means of intervention and a dynamic partnership; • technological risks: increasing frequency; special impact; complex and specialized means of response; • biological risks: cyclicity; unpredictability; large area of manifestation; important preventive and control measures.

#	Name of the document	Type	Web link	Scope	Year	Main sectors	Main target/ Aim
10	**The National Strategy regarding the Circular Economy**	Policy	https://dezvoltaredurabila.gov.ro/strategia-nationala-privind-economia-circulara-prima-varianta-13409762	National	2022	• Finance, Economy • Biodiversity and natural heritage	The general objective of SNEC in Romania is to provide the framework for the transition to EC, through the implementation of the Action Plan. The success indicator of this transition is the decoupling of economic development from the use of natural resources and environmental degradation. The overall objective of SNEC is closely linked to the SDGs of the UN 2030 Agenda and the global climate targets, as well as the new EU targets in the PAEC, in line with the principles and actions promoted under the Green Deal. At the national level, elements of the transition to EC in Romania are also provided in the National Strategy for the Sustainable Development of Romania 2030 – SNDDR 20301 and in PNRR2.
11	**Strategy for sustainable transport for the period 2020-2030**	Strategy	https://www.mt.ro/web14/documente/strategie/strategii_sectoriale/strategie_dezvoltare_durabila_noua_ultima_forma.pdf	National	2008 (& 2019)	• Transport	The general objective is the balanced development of the national transport system that ensures a modern and sustainable transport infrastructure and services, the sustainable development of the economy and the improvement of the quality of life. Achieving this objective will contribute directly to ensuring the sustainable development of the transport sector, the economy and the environment, to increasing the degree of accessibility of Romania, ensuring the inter-modality of the transport system, promoting the balanced development of all modes of transport and improving the quality and efficiency of services.

The sections below include the detailed analysis of the relevant documents performed within the Tulcea Case Study.

11.9.1. Annex 5.1. Deep analysis of document #1 of CS5

Table 111. Document #1 of CS5 Danube Delta deeply analysed

Case Study	**CS5 – Wetland Danube Delta (RO)**			
#1	**National strategy on adaptation to climate change for the period 2022-2030 in the perspective of 2050 (SNASC)**			
Type of document	Strategy		**Language(s)**	Romanian
Scope	National		**Year of adoption**	2022
Web link	http://www.mmediu.ro/app/webroot/uploads/files/SNASC_SEA_2022.pdf		**Target year**	2030 / 2050
Brief description	SNASC is a strategic programming document covering the areas of (1) Water resources, (2) Forests, (3) Biodiversity and ecosystem services, (4) Population, public health and air quality, (5) Education and awareness, (6) Cultural Heritage, (7) Urban Systems, (8) Agriculture and Rural Development, (9) Energy, (10) Transport, (11) Tourism and Recreation, (12) Industry and (13) Insurance.			
Sectors involved	Energy	Cities and urban planning	Industry and commerce	
	Water and waste	Agriculture, forestry and fisheries		
Main target addressed	The general objective of SNASC is to **improve the capacity to adapt and increase the resilience of socio-economic and natural systems to the effects of climate change**, in different areas and time intervals. SNASC ensures continuity and coherence with the adaptation component of the "National Strategy on climate change and economic growth based on low carbon emissions for the period 2016-2030". At the same time, SNASC aims at sectoral development in accordance with the principles of the New EU Strategy on adaptation to climate change, namely smart, rapid, systemic and connected adaptation at the global scale of action. SNASC and PNASC do not present hierarchical subordination to other strategic documents on the same sector. However, vertical links can be identified with a series of strategic documents promoted at the European level: (1) the New EU Strategy on Adaptation to Climate Change, (2) the European Climate Pact, (3) the Plan for achieving the 2030 climate objective, (4) Action Plan regarding the Circular Economy, (5) the Action Plan towards a Zero Pollution for Air, Water and Soil, (6) the EU Strategy for the Integration of the Energy System, (7) the Strategy for a sustainable and intelligent mobility - putting European transport on the path of the future, (8) New EU Forest Strategy 2030, (9) EU Biodiversity Strategy 2030, (10) Farm to Fork Strategy, (11) EU Soil Strategy 2030, (11) EU Tourism Strategy sustainable, (12) Legislative package "Prepare for 55: meeting the EU climate target for 2030 on the path to achieving the objective of climate neutrality and (13) The European Research Strategy for the period 2020–2024. There are also horizontal links and synergies with the following national strategic documents: (1) the National Strategy for the Sustainable Development of Romania 2030 (SNDDR), (2) the National Recovery and Resilience Plan (PNRR), (3) the National Management Plan of Disaster Risks (PNMRD), (4) the National Integrated Plan in the field of Energy and Climate Change 2021-2030 (PNIESC).			
Other relevant objectives or strategies addressed				
O1	The New EU Strategy on Adaptation to Climate Change			
O2	The European Climate Pact			
O3	The Plan for achieving the 2030 climate objective			
O4	Action Plan regarding the Circular Economy			
O5	The Action Plan towards a Zero Pollution for Air, Water and Soil			
O6	The EU Strategy for the Integration of the Energy System			

O7	The Strategy for a sustainable and intelligent mobility – putting European transport on the path of the future
O8	New EU Forest Strategy 2030
O9	EU Biodiversity Strategy 2030
O10	Farm to Fork Strategy
O11	EU Soil Strategy 2030
O12	EU Tourism Strategy sustainable
O13	The European Research Strategy for the period 2020–2027
Relevant policies and measures included	
P&M1	The National Strategy for the Sustainable Development of Romania 2030 (SNDDR)
P&M2	The National Recovery and Resilience Plan (PNRR),
P&M3	The National Disaster Risk Management Plan (PNMRD)
P&M4	The National Integrated Plan in the field of Energy and Climate Change 2021-2030 (PNIESC)
Actuation areas	National level (Romania).
Additional relevant information	The owner of the document is the Ministry of Environment, Waters and Forests through General Directorate for Impact Assessment, Control Pollution and Climate Change and the local institutions-Environment Protection Agency, Danube Delta Biosphere Reserve Administration, The Forestry Department, The Water Management System.

11.9.2. Annex 5.2. Deep analysis of document #2 of CS5

Table 112. Document #2 of CS5 Danube Delta deeply analysed

Case Study	**CS5 – Wetland Danube Delta (RO)**		
#2	**Romania's energy strategy 2022-2030, in the perspective of 2050**		
Type of document	Project	**Language(s)**	Romanian
Scope	National	**Year of adoption**	2022
Web link	https://energie.gov.ro/wp-content/uploads/2022/08/Strategia-2030_DGJRI_AM_12.08.2022_MU_Clean_25.08.2022-1.pdf	**Target year**	2050
Brief description	The Energy Strategy has eight fundamental strategic objectives that structure the entire analysis and planning approach for the period 2022-2030 and the time horizon of 2050. The achievement of the objectives requires a balanced approach to the development of the national energy sector both from the perspective of national and European regulations, as well as from that of investment expenses.		
Sectors involved	Energy		
Main target addressed	The Energy Strategy proposes concrete objectives, establishes clear directions and defines the milestones by which Romania will maintain its position as an energy producer in the region and as an active and important actor in the management of stress situations at the regional level.		
Other relevant objectives or strategies addressed			
O1	Modernizing the corporate governance system and institutional regulatory capacity		
O2	Clean energy and energy efficiency		
O3	Romania, regional supplier of energy security		
O4	Increasing Romania's energy contribution to the regional and European markets		

O5	Ensuring access to electricity, heat and natural gas for all consumers
O6	Protection of the vulnerable consumer and reduction of energy poverty
O7	Competitive energy markets, the basis of a competitive economy
O8	Increasing the quality of education and innovation in the field of energy and training continuous human resource
O9	Romania, regional supplier of energy security
O10	Increasing Romania's energy contribution to the regional and European markets
Relevant policies and measures included	
P&M1	Diversified and balanced energy mix
P&M2	Development of new deposits if primary resources to maintain a low level of energy dependence and for the security in operation of the national energy system
P&M3	Increasing the interconnection capacities of energy transmission networks
P&M4	Ensuring energy storage capacity and a reserve systems
P&M5	Increasing the flexibility of the national energy system through digitalization, smart grids and by developing the category of active consumers (prosumer)
P&M6	Protection of critical infrastructure against physical, computer attacks and disasters
P&M7	Romania’s proactive participation in the initiatives. European energy diplomacy
P&M8	Development of Romania’s strategic partnerships in the energy dimension
P&M9	Replacement, at the horizon of the year 2030, of electricity production capacities which will come out of operation with new, efficient capacities and with reduced emissions
P&M10	Increasing energy efficiency through the entire value chain of the energy sector
P&M11	Increasing competition in domestic energy markets
P&M12	Liberalization of energy markets and their regional integration so that the energy consumer can benefit from the best energy price
P&M13	Efficiency of the economic activity of energy companies with state capital
P&M14	Economic and fiscal policies to stimulate investments in the development of the manufacturing industry of SRE, energy efficiency and electromobility equipment
P&M15	Reduction of gas and NOx emissions in the energy sector
P&M16	Sustainable development of the national energy sector, with the protection of air, water, soil and biodiversity quality
P&M17	Fair participation in the collective effort of the EU member states to achieve energy efficiency, SRE and GHG emissions reduction targets
P&M18	Separation of the function of the state as owner and shareholder from that of arbitrator of the energy market
P&M19	Transparency of the administrative act, simplification of bureaucracy in the energy sector
P&M20	Supporting education and promoting scientific research, health and safety at work
P&M21	Improving corporate governance of companies with state capital
P&M22	Institutional capacity development
P&M23	Increasing population access to electricity, thermal energy and natural gas
P&M24	Reduction of energy poverty and protection of vulnerable consumers

P&M25	Climate change adaptation and prevention, and risk management
Actuation areas	National level (Romania).
Additional relevant information	The Ministry of Energy constantly monitors the energy sector, including the implementation stage of the Energy Strategy 2022-2030, with the perspective of 2050. The action plans and measures necessary to achieve the strategic objectives will be followed closely, to ensure funding sources and the development of investment projects in optimal conditions. The regular update of the Strategy takes into account the changes taking place at the local, regional, European and global level. The implementation of the Energy Strategy is correlated with the national and international context, both evolving in dynamic interdependence. The transformation of the economic climate imposes new trends in the development of society and its needs. New technologies and energy products reorient investment choices, trust in energy processes, as well as the structure of the electric power system. To respond to changes in context, once every five years, there will be: • updating data and system analysis; • a new qualitative analysis of trends in the national energy system; • redefinition of scenarios and a new quantitative modelling; • review of targets and action priorities. The Energy Strategy is based on the development of competitive markets for electricity, natural gas and other primary resources, which leads to the need for new approaches as market trends change.

11.9.3. Annex 5.3. Deep analysis of document #3 of CS5

Table 113. Document #3 of CS5 Danube Delta deeply analysed

Case Study	**CS5 – Wetland Danube Delta (RO)**		
#3	**Romania's national action plan in the field of energy efficiency**		
Type of document	Plan	**Language(s)**	Romanian
Scope	National	**Year of adoption**	2016
Web link	https://energy.ec.europa.eu/system/files/2020-04/ro_final_necp_main_ro_0.pdf	**Target year**	2030
Brief description	This Plan integrates with priority the objectives and directions established by the specific strategies in the field of energy, respectively of climate change, at the same time being based on the programmatic documents also initiated by other ministries/authorities.		
Sectors involved	Energy		
Main target addressed	Improving energy efficiency is one of the priority elements of Romania's energy strategy, considering the major contribution to achieving security of supply for consumers, ensuring sustainable development and competitiveness, saving energy resources and reducing greenhouse gas emissions.		
Other relevant objectives or strategies addressed			
O1	Decarbonisation		
O2	Energetic efficiency		
O3	Energy security		
O4	Internal energy market		
O5	Research, innovation and competitiveness		
Relevant policies and measures included			

P&M1	GHG emissions and absorptions
P&M2	Energy from renewable sources
P&M3	Other elements of the dimension
P&M4	Electricity infrastructure
P&M5	Energy transport infrastructure
P&M6	Market integration
P&M7	Energy poverty
Actuation areas	National level (Romania).
Additional relevant information	The Ministry of Energy constantly monitors the energy sector, including the implementation stage of the Energy Strategy 2022-2030, with the perspective of 2050. The action plans and measures necessary to achieve the strategic objectives will be followed closely, to ensure funding sources and the development of investment projects in optimal conditions. The regular update of the Strategy takes into account the changes taking place at the local, regional, European and global level. The implementation of the Energy Strategy is correlated with the national and international context, both evolving in dynamic interdependence. The transformation of the economic climate imposes new trends in the development of society and its needs. New technologies and energy products reorient investment choices, trust in energy processes, as well as the structure of the electric power system. To respond to changes in context, once every five years, there will be: • updating data and system analysis; • a new qualitative analysis of trends in the national energy system; • redefinition of scenarios and a new quantitative modelling; • review of targets and action priorities. The Energy Strategy is based on the development of competitive markets for electricity, natural gas and other primary resources, which leads to the need for new approaches as market trends change.

11.9.4. Annex 5.4. Deep analysis of document #4 of CS5

Table 114. Document #4 of CS5 Danube Delta deeply analysed

Case Study	**CS5 – Wetland Danube Delta (RO)**		
#4	**Romania's Strategy for Sustainable Development 2030**		
Type of document	Strategy	**Language(s)**	Romanian, English
Scope	National	**Year of adoption**	2018
Web link	https://dezvoltaredurabila.gov.ro/files/public/10000001/Romania-Sustainable-Development-Strategy-2030-en.pdf	**Target year**	2030
Brief description	The three pillars on which the 2030 Agenda for Sustainable Development rests were first defined in the Brundtland Commission (1987) report. These pillars are: 1. SOCIAL EQUITY – developing nations should be able to meet their basic needs regarding employment, food supply, energy security, water, and sewerage 2. ECONOMIC GROWTH – developing nations should be able to achieve a quality of life close to those of developed nations 3. THE ENVIRONMENT – encapsulating the need to conserve and increase the amount of available resources through a gradual shift in the way different technologies are developed and used.		
Sectors involved	Biodiversity and natural heritage		

Main target addressed	Romania, as a member of the United Nations (UN) and the European Union (EU), has adopted the 2030 Agenda and its 17 Sustainable Development Goals. The 2030 Agenda was adopted at the United Nations Sustainable Development Summit though UN General Assembly resolution A/RES/70/1. The European Council endorsed this Agenda in "A Sustainable European Future: The EU Response to the 2030 Agenda for Sustainable Development" on 20 June 2017. The Council's document represents the political document to which the member states have committed themselves, setting the direction EU member states should follow in their task of implementing the 2030 Agenda for Sustainable Development. Romania's Sustainable Development Strategy 2030 (hereafter referred to as the "Strategy") defines Romania's national framework for implementing the 2030 Agenda for Sustainable Development, providing a roadmap for achieving the 17 SDGs. This strategy promotes the sustainable development of Romania by focusing on Sustainable Development's three dimensions: economic, social, and environmental. This strategy is citizen-centred and focuses on innovation, optimism, resilience, and the belief that the role of the state is to serve the needs of each citizen in a fair, efficient, and balanced manner, all within a clean environment.
Other relevant objectives or strategies addressed	
O1	**End poverty in all its forms everywhere** • Eradicate extreme poverty for all citizens • Reduce by at least by half the number of citizens living in relative poverty • Consolidate the unified national system of emergency intervention, rehabilitation, and compensation services in the event of natural disasters, industrial accidents, or extreme weather events
O2	**End hunger, achieve food security and improved nutrition and promote sustainable agriculture** • Eliminate malnutrition and keep the rate of obesity under 10%, i.e. similar to the 2014 level • Finalisation of the agricultural cadastre • Double the share of agriculture in Romania's GDP relative to 2018 • Maintain and increase the genetic diversity of seeds, crops and farm, and both domestic animals and related wild species • Increase the use of local agricultural production • Increase the share of ecological agriculture in total agricultural production • Preserve and capitalise on occupations and traditional uses of medicinal plants and forest fruit in mountain areas; maintain local traditions by increasing the number of products with special characteristics in terms of rules of origin
O3	**Ensure healthy lives and promote well-being for all at all ages** • Ensure universal access to information, education, and counselling services in order to encourage prevention and the adoption of a healthy lifestyle • Ensure the complete digitalisation of the health system and implicitly the elimination of documents and records printed on paper, in order to increase the efficiency of and facilitate medical interventions, thereby ensuring the population's rapid access to quality medical services, treatment and medication, and the efficient monitoring of needs • Reduce the prevalence of maternal and infantile mortality and the incidence of breast and cervical cancer, and teenage pregnancies, with the primary focus on vulnerable and disadvantaged groups • Reduce maternal mortality and neonatal mortality to below the EU average • Increase vaccination coverage to the minimum level recommended by the WHO for each vaccine by developing a common platform for collaboration between the authorities, doctors, patients, international organisations with experience in the field, representatives of companies working in the field and other interested parties • Promote awareness of mental illness, reduce the associated stigma and create an environment in which those suffering from mental illness feel accepted and able to ask for help • Eliminate the contraction of tuberculosis and combat hepatitis and other transmissible diseases • Reduce by one third the number of premature deaths due to non-transmissible diseases through prevention and treatment and by promoting mental health and well-being • Reduce the death rate from chronic diseases • Reduce the level of consumption of toxic substances
O4	**Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all** • Reduce the rate of early school leaving in the educational system

	• Achieve an education system based on ability and focused on the needs of the pupils, who should enjoy greater freedom in choosing what they study through measures such as introducing and increasing the amount of optional subjects • Ensure that all pupils acquire the necessary skills and knowledge to be able to promote sustainable development, including through education for sustainable development and sustainable lifestyles, human rights and gender equality, to promote a culture of peace and non-violence, and to appreciate cultural diversity and the contribution of culture to sustainable development • Emphasise the role played in the educational process by civic education, by the principles and notions relating to a peaceful and inclusive sustainable society, the values of democracy and pluralism, the values of multiculturalism, the prevention of discrimination and an understanding of the point of view of the "other", and the importance of eradicating violence with a focus on the phenomenon of violence in schools and gender equality • Modernise the education system by adapting the methods of teaching and learning to the use of information technology and increase the quality of education • Organise vocational and technical education into specially designed and equipped campuses; train qualified teaching staff; create a curriculum tailored to the needs of the labour market by developing partnerships, including with the business community • Expand facilities for lifelong continued training and learning, considerably increase participation in formal and non-formal systems of knowledge with a view to bringing Romania's performance closer to the EU average • Expand the network of community-based permanent education centres by the local authorities; continue to involve companies in supporting employee enrolment in such programmes • Substantially increase the number of youth and adults with relevant skills, including technical and vocational skills, so as to encourage employment, the creation of decent jobs and entrepreneurship • Increase the level of financial literacy among citizens • Expand the concept of sustainable development in formal university education as a principle and a specialisation, and highlight the role of interdisciplinary research in the development of a sustainable society
O5	**Achieve gender equality and empower all women and girls** • Continue to reduce the gender pay gap • Eliminate all forms of violence against women and girls in both the public and private sphere, including trafficking, sexual exploitation, and other forms of exploitation • Ensure the full and effective participation and equal opportunities of women when it comes to employment in management positions at all levels of political, economic, and public life
O6	**Ensure availability and sustainable management of water and sanitation for all** • Substantially increase the efficiency of water use in industrial, commercial, and agricultural activities; expand the rational reuse of treated and recycled water with a view to meeting the requirements of a circular economy • Substantially increase the efficiency of water use in all sectors and ensure a sustainable process of abstraction and supply of drinking water in order to address water shortages • Connect at least 90% of households in towns, communes, and compact villages to the drinking water and sewerage network • Increase access to drinking water among vulnerable and marginalised groups • Improve water quality by reducing pollution, eliminating waste disposal, and reducing to a minimum the amount of chemical products and dangerous substances, thereby reducing the proportion of untreated waste water, and significantly increasing recycling and safe reuse • Provide access to adequate and equitable sanitary and hygienic conditions for all with a special focus on those in vulnerable situations
O7	**Ensure access to affordable, reliable, sustainable and modern energy for all** • Expand electricity and gas distribution networks with a view to ensuring household consumer, industrial and commercial access to safe sources of energy at acceptable prices • Ensure the cyber security of the platforms for the monitoring of production, transport and supply networks for electricity and natural gas • Decouple economic growth from the process of resource depletion and environmental degradation by substantially boosting energy efficiency (by a minimum of 27% compared with the status quo) and the extensive use of the EU Emission Trading Scheme (ETS) in stable and predictable market conditions • Increase the share of renewable energy and low-carbon fuel used in the transport sector (electric vehicles), including the use of alternative fuels

	• Ensure a stable and transparent regulatory framework in the field of energy efficiency with a view to attracting investment • Strategically support the share of electricity in total household, industrial and transport consumption by establishing performance standards for facilities and equipment
O8	**Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all** • Maintain a GDP growth rate above the EU average in order to help reduce the gap between Romania and the more advanced European economies, while still respecting the principles of sustainable development and continuously improving the living standards of the population • Promote development-oriented policies that support productive activities, the creation of decent jobs, entrepreneurship through start-ups, creation and innovation, and which encourage the formalisation and growth of micro, small and medium-sized enterprises, including through access to financial services • Achieve high levels of productivity through diversification, technological modernisation, and innovation, including through focusing on sectors with high added value and a more intensive use of the workforce • Create a tourism sector that is competitive in the long time, develop agritourism, ecotourism, and rural, spa and cultural tourism, and improve Romania's image as a tourist destination • Strengthen the capacity of domestic financial institutions in order to encourage and expand access to banking, insurance and financial services for all
O9	**Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation** • Modernise and develop quality, viable, sustainable, and powerful regional and cross-border infrastructure, in order to support economic development and human well-being, with a focus on fair and equitable access by all • Improve road safety • Rehabilitate the industrial sector in order to make it sustainable through a more efficient use of resources and increased adoption of clean and ecological industrial technologies and processes, with all countries implementing measures in keeping with their respective capacities • Stimulate in particular the digital economy and investment in industries which are at the more profitable end of the value chain, which utilise the results of national efforts in the area of research, development and innovation, and which target stable and growing markets • Boost scientific research and modernise the technological capacity of the industrial sectors; encourage innovation and significantly increase the number of employees in research and development and increase public and private spending on research and development • Promote inclusive and sustainable industrialisation and increase the rate of employment • Increase the access of small industrial and other companies to financial services, including accessible loans, and integrate them into value chains and external markets
O10	**Reduce inequality within and among countries** • Adopt policies, especially in the areas of fiscal, salary and social protection policy, that aim gradually to reduce inequality and the percentage of disadvantaged groups • Bring Romania closer to the EU average for 2030 in terms of the indicators for sustainable development • Reduce discrimination by supporting non-governmental organisations working in the field of human rights
O11	**Make cities and human settlements inclusive, safe, resilient and sustainable Ensure access to decent living conditions for all citizens** • Significantly reduce the economic losses caused by flooding and landslides, improve the collective response and strengthen the capacity to adapt and return to a functional situation in the shortest time possible after occurrence of the event, reduce the impact of flooding or the pollution caused by flooding and landslides on the ecosystem, including by means of constant improvements to the legislative framework • Ensure access to safe, fairly-priced, accessible and sustainable transport systems for all, in particular by extending public transport networks, with a special focus on the needs of those in vulnerable situations, women, children, people with disabilities and the elderly • Draw up and implement a general programme of spatial and land-use planning in correlation with the sectoral strategies at national level through application of the concept of polycentric and balanced spatial development in order to support territorial cohesion • Educate and empower the population in respect of earthquake risk situations • Reduce the impact atmospheric pollution has on human health and the environment through a special focus on air quality

	• Substantially reduce the number of deaths and diseases caused by dangerous chemical products, pollution and the contamination of the air, water and soil • Consolidate efforts to protect and safeguard cultural and natural heritage and landscape features from the rural and urban environment • Implement the relevant legal provisions regarding the production, transport, storage, use and disposal of chemical products, including pharmaceutical products, which can be dangerous to human and animal health as well as environmental integrity
O12	**Ensure sustainable consumption and production patterns** • Gradually transition to a new development model based on the rational and responsible use of resources by introducing elements of the circular economy and drawing up a road map • Halve per capita food waste at the level of retail and consumption and reduce food waste throughout the production and supply chain, including post-harvest losses • Recycle 55% of municipal waste by 2025 and 60% by 2030 • Recycle 65% of packaging waste by 2025 (plastic materials 50%, wood 25%, ferrous metals 70%, aluminium 50%, glass 70%, paper and cardboard 75%) and 70% by 2030 (plastic materials 55%, wood 30%, ferrous metals 80%, aluminium 60%, glass 75%, paper and cardboard 85%) • Implement the separate collection of household hazardous waste by 2022, of biological waste by 2023 and of textile waste by 2025 • Establish extended producer responsibility schemes for all types of packaging by 2024 • Implement sustainable green public procurement practices in conformity with national priorities and European policy
O13	**Take urgent action to combat climate change and its impacts** • Strengthen Romania's resilience and capacity to adapt to climate-related risks and natural disasters • Enhance capacity to react rapidly to unexpected extreme weather events • Improve education, awareness and human and institutional capacity with regard to mitigating climate change, adapting to and reducing the impacts of climate change, and the implementation of early warning systems • Intensify Romania's efforts to achieve the transition to a "green" economy, characterised by low carbon dioxide emissions and resilience to climate change, and to integrate measures with a view to adapting to climate change in vulnerable economic, social and environmental sectors, in keeping with EU policies
O14	**Conserve and sustainably use the oceans, seas and marine resources for sustainable development** • Prevent and significantly reduce all forms of marine pollution, in particular that resulting from land-based activities, including pollution with marine litter and nutrient pollution • Minimise and manage the effects of the acidification of marine waters, including by increased scientific cooperation at all levels • Responsibly and sustainably manage the fishing of wild and aquaculture species in accordance with the legally established quotas and methods, and preserve, within reasonable limits, the viability of traditional activities in this field, including recreational and sports fishing • Involve other Black Sea countries in the implementation of a responsible and sustainable plan for the exploitation of living aquatic species
O15	**Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss** • Develop green infrastructure and make use of the services offered by natural ecosystems (in particular the Danube floodplains, its tributaries and the Danube Delta) through the integrated management of river basins and wetlands • Conserve and protect wetland areas, which also include the Danube Delta Biosphere Reserve, a unique wetland in Romania and part of European and world natural heritage • Ensure the conservation of mountain ecosystems, including their biodiversity, with a view to boosting their capacity to provide essential benefits in terms of sustainable development • Support the research and development institutions and infrastructure of national and European importance in the study, management, protection and preservation of the diversity of natural heritage • Sustainably manage forests, eradicate illegal logging, develop an integrated digital system for the monitoring of the exploitation and transport of timber, including at border crossings, ensure the afforestation and reforestation of forest land or land that has been degraded or subject to desertification, and implement the

	planned planting of shelterbelts to shield crops and elements of infrastructure from the impacts of climate change • Pursue the transition to a circular economy through complementary approaches involving traditional methods and the latest technologies in order to re-establish/rebuild natural capital and reduce dependence on synthetic fertilisers and pesticides, with a view to combating soil degradation • Combat desertification, restore degraded land and soil, including land affected by desertification, drought and flooding
O16	**Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels** • Administer justice impartially and with celerity in compliance with established laws and procedures, while respecting the principle of the presumption of innocence • Ensure and encourage dialogue with national minorities with a view to improving decision-making through equal access for all citizens, such that they are able to respect and express their culture, traditions and mother tongue and participate in the economic, social and political life, and with a view to combating preconceptions, prejudice and discrimination in all its forms and encouraging interethnic dialogue, common values and cultural and linguistic diversity • Significantly reduce all forms of violence and the associated death rate • Put a stop to the abuse, exploitation, trafficking and all forms of violence and torture of children • Significantly reduce illicit financial flows and arms dealing, improve the recovery and return of stolen goods and combat all forms of organised crime • Ensure a receptive, inclusive, participative and representative decision-making process at all levels • Develop efficient, responsible and transparent institutions at all levels • Professionalise and improve the work of all central and local public administrative institutions, especially those departments that come into direct contact with citizens, in order to provide prompt and civilised services; expand and universalise online digitalised services
O17	**Strengthen the means of implementation and revitalise the global partnership for sustainable development** • Gradually increase the quantity of official development aid granted by Romania through ODA programmes, depending on the capacity of the national economy to support this, with the goal of reaching 0.33% of gross national income by 2030 • Increase and diversify official development assistance in line with growth in Romania's economic potential and encourage Romanian economic agents to invest on competitive grounds in the economies of less developed countries • Romania's joining of the Eurozone, the Schengen Area, and the Organisation for Economic Cooperation and Development (OECD) • Support Romania's international commitments and proactive involvement on the European and international level
Actuation areas	National level (Romania).
Additional relevant information	**Reporting at EU and UN level.** The Department of Sustainable Development will submit periodic reports to the EU on the progress made by Romania in terms of the implementation of the 2030 Agenda for Sustainable Development as well as the country's active participation in the new European and global consensus on development. This is due to the fact that this ambitious project, which the EU has committed itself to spearheading its implementation, addresses our Planet's challenges which, for the first time, have become universally accepted by, and applicable, to all nations. As part of the follow-up and review mechanism established by the 2030 Agenda at UN level, the member states are encouraged to conduct periodic progress assessments. By 2018, 102 countries had presented voluntary reports to the High-level Political Forum (HLPF) on Sustainable Development, including Romania. By 2030, Romania aims to present at least two more reports.

11.9.5. Annex 5.5. Deep analysis of document #5 of CS5

Table 115. Document #5 of CS5 Danube Delta deeply analysed

Case Study	**CS5 – Wetland Danube Delta (RO)**		
#5	**The integrated strategy for sustainable development of the Danube Delta**		
Type of document	Strategy	**Language(s)**	English, Romanian
Scope	Local	**Year of adoption**	2016 (and updated in 2020)
Web link	https://www.mdlpa.ro/userfiles/delta_dunarii/rezultate_proiecte/4_Raport_Strategie_en.pdf	**Target year**	2030
Brief description	The strategy ensures the balance between protecting the unique natural heritage of the Danube Delta Biosphere Reserve (RBDD) and socio-economic development meeting the aspirations of the area's inhabitants by improving living conditions, creating better economic opportunities and an adequate capitalization of the natural and cultural heritage.		
Sectors involved	Agriculture, forestry and fishing	Biodiversity and natural heritage	Cities and urban planning
Main target addressed (#1)	**Strategic Objective no. 1**: Conserve the unique environmental assets through scientifically guided environmental management, and by empowering the local communities to be proactive guardians of this unique global heritage.		
Other relevant objectives or strategies addressed			
O1	**Pillar I**: Protecting the environmental and natural resource assets		
Relevant policies and measures included			
P&M1	Environment, Biodiversity, Forests		
P&M2	Climate Change and Energy Efficiency		
P&M3	Disaster Risk Management (DRM), and Pollution Emergency		
Main target addressed (#2)	**Strategic Objective no. 2**: Develop a green and inclusive local economy, based on sustainable consumption and protection, resource efficient, capitalizing on the area's comparative advantages, supported by improved public services.		
Other relevant objectives or strategies addressed			
O2	**Pillar II**: Improving the economy		
O3	**Pillar III**: Improving connectivity		
O4	**Pillar IV**: Providing		
O5	**Pillar V**: Promoting efficiency, affordability and sustainability (including Administrative Capacity of Local Authorities, and Technical Assistance for Program Implementation)		
Relevant policies and measures included			
P&M4	Tourism Fishery and Aquaculture		
P&M5	Agriculture & Rural Development		
P&M6	Information and Communication Technology (ICT)		
P&M7	Water Supply and Sewerage Solid Waste Management		
P&M8	Education Health Social Inclusion and protection		
P&M9	Transport		
Actuation areas	Danube Delta and the Biosphere Reserve Area		

Additional relevant information	Strategy Implementation Arrangements According to the Protocol signed by the Ministry of European Funds, the Ministry of Regional Development and Public Administration, the Ministry of Agriculture and Rural Development, and the DD ITI Inter-Community Development Association, the four entities share responsibilities for the implementation of Danube Delta Integrated Sustainable Development Strategy (DDIS), as follows: • MRDPA is the national authority responsible for formulating and monitoring the implementation of the DDIS, and it is also the Management Authority for the operational programmes on Administrative Capacity and for the European Territorial Cooperation Programmes; • MEF is the national coordinator of European Structural and Investment Funds 2014-2020, as well as being the Management Authority for the OPs for Technical Assistance, Large Infrastructure, Human Capital, and Competitiveness; • MARD is the national authority responsible for coordinating the implementation of the Common Agricultural Policy and of the Common Fisheries Policy, as well as being the Management Authority for the National Rural Development Program (NRDP) and the Fisheries and Maritime Affairs OP; • IDA – DD ITI will coordinate the implementation of the Action Plan of the DDIS. The coordination of the activities of the three ministries will be performed through the Functional Working Group (FWG) for the Danube Delta ITI, with representatives from each ministry. The FWG Secretariat will be established by the Department for Analysis, Programming and Evaluation at the MEF. The DD ITI IDA is a structure representative of the local authorities in the Danube Delta Region (the ITI area). According to its statute, it supports the local beneficiaries – the local public administrations, the public and private institutions, the members or non-members – in implementing the projects strongly related to the DDIS approved in the Action Plan. The local beneficiaries – the local public administrations, the public and private institutions – are the responsible parties for the strategy implementation. They will need to establish Project Implementation Units (PIU) within their organizations responsible for the coordination and implementation of project activities. The project management may be contracted out to specialized companies through applicable procurement procedures.

11.9.6. Annex 5.6. Deep analysis of document #6 of CS5

Table 116. Document #6 of CS5 Danube Delta deeply analysed

Case Study	**CS5 – Wetland Danube Delta (RO)**		
#6	**National disaster risk management plan**		
Type of document	Policy	**Language(s)**	Romanian
Scope	National	**Year of adoption**	2020
Web link	https://igsu.ro/Resources/COJ/ProgrameStrategii/pdf24_merged.pdf	**Target year**	2035
Brief description	The systematic, unitary and inter-institutional approach to the measures and actions necessary to be implemented to ensure prevention, preparation and adequate response, at system level, in accordance with international guidelines and with Romania's obligations arising from the status of a member state of the European Union and the UN on disaster risk reduction.		
Sectors involved	Cities and urban planning		
Main target addressed (#1)	**Seismic Risk Reduction**		
Other relevant objectives or strategies addressed			
O1	The transformation of Romania's built stock into an earthquake-resistant built stock by 2050		
O2	Reducing the seismic risk at the national level by saving lives, reducing injuries and protecting the built fund through prioritized and efficient investments		

O3	Promoting well-being by creating related benefits by improving energy efficiency and sanitary conditions, among other functional aspects
O4	Increasing resilience by integrating seismic/multi-risk considerations into territorial and sectoral planning and ensuring resilient post-earthquake recovery and reconstruction processes
O5	Mobilizing inclusive participation and action by increasing the level of public awareness regarding seismic risk management and increasing the level of commitment in the implementation of risk reduction measures
Relevant policies and measures included	
P&M1	The land development, urban planning and construction code
P&M2	The national housing strategy
Additional relevant information	The organization of the system is in accordance with the obligations that Romania has as part of international treaties and agreements, especially as a member state of the European Union, considering the cross-border nature of contemporary risks. Components of the national emergency management system: • Committees for emergency situations; • Department for Emergency Situations; • General Inspectorate for Emergency Situations; • Professional emergency services and voluntary emergency services; • Operative centres and intervention coordination and management centres; • Operative centres for emergency situations; • the commander of the action. In addition to the national programs for the financing of investments in the consolidation of buildings and the financing of support activities, these types of works will benefit from the European funds allocated through the Operational Programs 2021-2027, through the National Recovery and Resilience Plan, the National Investment and Economic Recovery Plan, as well as from other external sources.
Main target addressed (#2)	**Continue efforts to reduce flood risks**
Other relevant objectives or strategies addressed	
O6	Adapting the rules for the exploitation of reservoirs taking into account the available water resource in climate change scenarios but also the water requirements of future users, including the environmental requirement for the protection and conservation of the aquatic ecosystem
O7	The development of new engineering infrastructures that transform water resources into social-economic resources, respectively the construction of new reservoirs under the conditions of conserving and increasing the biodiversity of aquatic flora and fauna
O8	Construction of new water derivations to ensure inter-basin water transfer
O9	Investments in water resource storage technology or in the implementation of technological solutions for drought situations
O10	Re-evaluation of the legal, technical and economic regulations regarding the management of water resources in climate change scenarios
O11	Adaptation of the planning and design of water management systems both as a whole and on the specific components to take climate changes into account
O12	Evaluation of the effect of climate change on water resources and hydrological extremes and identification of trends in the evolution of hydrological parameters within research studies/projects
O13	Increasing the exchange of information from the scientific community that studies climate change to the general public and to the institutions that manage water resources
Main target addressed (#3)	**Soil drought risk reduction and managing climate change, floods and soil drought**

Other relevant objectives or strategies addressed	
O14	Strengthening the institutional capacity for improving climate change policies and adapting to the effects of climate change through the INFRAMETEO and RO-ADAPT projects
O15	Through the National Recovery and Resilience Plan19, infrastructure projects for adapting to climate change are also considered that address and compensate for the moisture deficit in the soil profile in order to combat the risk of pedological drought, including combating surface and deep soil erosion and correcting torrents, in hydrographic basins with high torrential hazard, through irrigation/soil moistening, drainage and drying systems
O16	With regard to the irrigation infrastructure, two investment components are considered: the rehabilitation of the existing irrigation infrastructure, which serves approx. 2.4 million hectares, with a value of works of approx. 3.4 billion Euros, respectively, the continuation of the construction of the Siret-Bărăgan Main Canal
O17	Investment works to rehabilitate the drainage and drainage infrastructure at over 400 facilities that would serve an area of 2.8 million hectares (with a value of investment works of approx. 1.1 billion euros) and another 220 facilities to combat soil erosion, which serve an area of 500,000 hectares (with an investment value of approximately 500 million euros), for which financing solutions are being sought
Main target addressed (#4)	**forest fire risk reduction**
Other relevant objectives or strategies addressed	
O18	Changing the behaviour of the population regarding the management of plant residues on agricultural land, this being the only element that can be acted upon and as a result of which positive effects can be found in reducing the incidence of forest fires
O19	Intensifying actions to inform and prepare the population, in parallel with the training of the authorities responsible for managing emergency situations generated by forest fires, as well as the development of communication strategies for each category of target audience
O20	Increasing human resources on the line of fire prevention control (especially those of stubble and dry vegetation which is still an unsolved problem at the national level)
O21	Provision of 30 tanker trucks for forest fires with a capacity of 3000 litres of water. These special vehicles will be able to provide interventions in hard-to-reach areas, with narrow access roads, objectives in the mountain area, focusing on fast movement, movement on rough terrain, the creation of the intervention device in a short time and the use of water with a yield of extinguishment raised. It is also planned to purchase heavy/medium helicopters and light helicopters
O22	Updating the technical instructions regarding the prevention and first intervention in forest fires
Main target addressed (#5)	**Epidemic risk management**
Other relevant objectives or strategies addressed	
O23	The continuation of actions in order to implement the measures identified in the directions established by the existing normative acts in the field: developing strategies for the control of communicable diseases (hepatitis, STD, tuberculosis)
O24	Increasing and maintaining the level of training of operative personnel on the first aid line in case of epidemics both through the already existing training centres and through the activities of the Multirisk Modul II and III projects, as well as equipping them with additional equipment: medical support containers logistics and a highly contagious patient transport container through the VISION 2020 project
O25	Developing institutional capacity at central and local level for health monitoring and pandemic response
O26	Adapting medical services to the real needs of the population and harmonizing them with demographic and health trends
O27	Improving the medical infrastructure for the control of epidemics and for the continuity and quality of the response to the needs of the medical services of the adequate population

O28	The development of the health information and informatics system for epidemic control and response in case of pandemics and the development of the network of reference laboratories in the field of microbiology
O29	Making a national inventory of public and private infrastructure (with beds and integrated or complex outpatient clinics, equipment)
O30	Establishment of a quarterly/semester/annual periodic reporting mechanism), establishment of a reporting quality assurance mechanism - reporting validation and feed-back to confirm data accuracy
Relevant policies and measures included	
P&M3	The annual program of actions regarding the design and execution of intervention works to reduce the seismic risk in buildings intended for multi-storey housing, classified by the technical expertise report in seismic risk class I
P&M4	National program of constructions of public interest or social, Sub-program "Works in urgent premium"
P&M5	National Local Development Program PNDL
P&M6	The annual program for the development of risk maps natural for earthquakes and landslides
P&M7	Regional Operational Program 2014-2020
P&M8	National Monument Restoration Program History (PNR)
P&M9	Investment program in culture
Actuation areas	National level (Romania).
Additional relevant information	There are 107 measures included in the Plan, that are to be implemented by 2027

11.9.7. Annex 5.7. Deep analysis of document #7 of CS5

Table 117. Document #6 of CS5 Danube Delta deeply analysed

Case Study	**CS5 – Wetland Danube Delta (RO)**		
#7	**The national strategy regarding social inclusion and poverty reduction for the period 2022—2027**		
Type of document	Strategy	**Language(s)**	Romanian
Scope	National	**Year of adoption**	2022
Web link	https://mfamilie.gov.ro/1/wp-content/uploads/2022/08/Anexa_HG_440_2022_MO_Partea_I_359Bis.pdf	**Target year**	2027
Brief description	The national strategy regarding social inclusion and poverty reduction for the period 2022-2027, hereinafter referred to as the Strategy, represents a catalytic factor of the efforts and commitment of the Government of Romania assumed for the sustainable development of Romania in the 2030 horizon and, at the same time, for ensuring a fair, dignified and prosperous life to its inhabitants, providing the general intervention framework for achieving social cohesion and combating the complex challenges generated by poverty and social exclusion and accentuated by the economic crisis seen in the context of the SARS-CoV-2 pandemic, paying special attention to the inclusion of vulnerable groups.		
Sectors involved	Society		
Main target addressed	**Reduction by at least 7%, compared to 2020, in the number of people at risk of poverty or social exclusion, until 2027**		
Main target addressed (#1)	**A decent living for all, based on the principle: "no one is left behind"**		
Other relevant objectives or strategies addressed			

O1	Ensuring adequate amounts of minimum income for a dignified life and a decent living
Relevant policies and measures included	
P&M1	1.1.1. Ensuring the right to social assistance for the citizens of each locality
P&M2	1.1.2. Guaranteeing adequate amounts of social assistance and social insurance benefits
P&M3	1.1.3. Ensuring an adequate and sustainable pension system
P&M4	1.1.4. Ensuring adequate wages from work by implementing the decent work agenda
P&M5	1.1.5. Revising the definitions of severe material deprivation, material deprivation and the risk of poverty and social exclusion (AROPE) against the economic and social changes imposed by the Covid 19 pandemic
Other relevant objectives or strategies addressed	
O2	The development and coordination of economic, social and administrative measures to contribute to reducing poverty and increasing social inclusion
Relevant policies and measures included	
P&M6	1.2.1. The inclusion of provisions related to the prevention of social polarization, economic and ethnic segregation, spatial segregation, regarding the social responsibility of enterprises in the economic development strategy of UAT, in community action programs, in criteria for awarding public contracts, for commissioning free of charge of the premises or in other actions of the administration within the legal limits, etc.
P&M7	1.2.2. Making public information accessible to all citizens, not addressing exclusively the people with disabilities
P&M8	1.2.3. Development of public-public and public-private partnerships in combating poverty and social exclusion
P&M9	1.2.4. Social and economic participation of vulnerable groups
P&M10	1.2.5. Increasing the access of vulnerable people to services of general public interest
P&M11	1.2.6. Ensuring business continuity and recovery and resilience measures in the social services system in the context of Covid-19 or other special situations
Main target addressed (#2)	**Social investment to promote cohesion**
Other relevant objectives or strategies addressed	
O3	Efficient, equitable and inclusive education and training
Relevant policies and measures included	
P&M12	2.1.1. Consolidation of the national scholarship system, expansion of social aid measures and other financial mechanisms
P&M13	2.1.2. Increasing the capacity of the educational community to provide educational services appropriate to the diversity of educational needs
P&M14	2.1.3. Stimulating participation in early care and education of children, especially those from disadvantaged groups
P&M15	2.1.4. Ensuring a unified approach to compulsory and quality education programs to avoid school failure and dropout
P&M16	2.1.5. Ensuring a safe, tolerant, inclusive and diverse educational environment
P&M17	2.1.6. Increasing the relevance of education and training offers on the labour market in the context of improving participation in lifelong learning
P&M18	2.1.7. Developing digital skills at all levels of education to reduce digital divides and increase socioeconomic inclusion
Other relevant objectives or strategies addressed	

O4	Full, fair and inclusive employment in the context of promoting competitive economic growth
Relevant policies and measures included	
P&M19	2.2.1. Customization of training programs and support services for participation in the labour market according to the characteristics of vulnerable groups through collaboration between public services of general interest
P&M20	2.2.2. Supporting initiatives to promote entrepreneurship, entrepreneurial initiatives and the social economy
P&M21	2.2.3. Reducing employment in the informal sector, with a focus on reducing the number of self-employed and unpaid family workers in agriculture and those who emigrate with the purpose of practicing informal work
P&M22	2.2.4. Sustaining and expanding tourism, with an emphasis on rural tourism or leisure activities
P&M23	2.2.5. Development and expansion of access to the labour market for the rural population
P&M24	2.2.6. Increasing the effectiveness of tripartite dialogue
P&M25	2.2.7. Improving working conditions
Main target addressed (#3)	**Social protection throughout a person's life**
Other relevant objectives or strategies addressed	
O5	A more efficient, more accessible and more resilient health system
Relevant policies and measures included	
P&M26	3.1.1. Strengthening the health system
P&M27	3.1.2. Ensuring equitable and non-discriminatory access to quality and cost-effective health services, as well as to medication, especially for vulnerable groups
P&M28	3.1.3. Improving public health and the performance of preventive services
P&M29	3.1.4. Improving intersectoral collaboration for better health of the population, especially vulnerable groups
Other relevant objectives or strategies addressed	
O6	Adequate, safe housing and basic services in a healthy environment and at affordable prices
Relevant policies and measures included	
P&M30	3.2.1. Increasing access to adequate housing for all categories of people, especially young people and other vulnerable groups, as well as people living in informal settlements
P&M31	3.2.2. Establishing criteria at national level for the granting of social housing
P&M32	3.2.3. Increasing the quality of housing conditions for low-income and vulnerable categories
P&M33	3.2.4. Integrated actions to reduce territorial inequalities and the integration of marginalized communities in rural areas
P&M34	3.2.5. Reducing the phenomenon of residential spatial segregation
Other relevant objectives or strategies addressed	
O7	Integrated social services, oriented to promoting independent living in the community
Relevant policies and measures included	
P&M35	3.3.1. Development of social services addressed to vulnerable groups while increasing their access to social services
P&M36	3.3.2. Strengthening the development of the network of social services at the local level
P&M37	3.3.3. Developing and/or strengthening the integrated approach to the intervention and the way of providing services at the community level

P&M38	3.3.4. Elimination/reduction of discrimination against vulnerable groups
P&M39	3.3.5. Promoting social inclusion in marginalized rural and urban areas
Main target addressed (#4)	**Improving the administrative capacity for the coordination of policies at national level in accordance with European requirements**
Other relevant objectives or strategies addressed	
O8	Consolidation of the institutional capacity of authorities and institutions in the labour and social protection sector
Relevant policies and measures included	
P&M40	4.1.1. Strengthening strategic planning capacity with full integration of all social innovation initiatives and development of an integrated monitoring and evaluation system
P&M41	4.1.2. Strengthening coordination mechanisms in the labour and social protection sector
P&M42	4.1.3. Increasing the institutional capacity of social assistance services by connecting to digital technology
P&M43	4.1.4. Consolidation and optimization of the electronic system for granting social assistance
Other relevant objectives or strategies addressed	
O9	Efficiency of the coordination of national policies in accordance with EU requirements
Relevant policies and measures included	
P&M40	4.2.1 Streamlining synchronization with the EU agenda for promoting social inclusion and poverty reduction
Other relevant objectives or strategies addressed	
O10	Promoting the active involvement of interested parties in the process of developing national and local public policies
Relevant policies and measures included	
P&M41	4.3.1 Promoting consultation with beneficiaries and stakeholders involved in the labour and social protection sector and their active participation
P&M42	4.3.2. Encouraging dialogue with the private sector
P&M43	4.3.3. Streamlining the process of participation of children, adolescents and young people in the adoption of decisions that concern them
Actuation areas	National level (Romania).
Additional relevant information	The monitoring of the strategy and the implementation of the measures provided for in the Plan is carried out through the national mechanism for the promotion of social inclusion in Romania, approved by Government Decision no. 1.217/2006 regarding the establishment of the national mechanism for the promotion of social inclusion in Romania, with subsequent amendments and additions. The institutions responsible for implementing the measures provided for in the Plan report annually to the Ministry of Labour and Social Solidarity the status of their implementation, based on the indicators provided for in the Plan, as well as based on the indicators of social inclusion, provided for in the annex to Government Decision no. 731/2021 for the approval of social inclusion indicators. The plan can be revised depending on the monitoring results and the national priorities in the field of social inclusion identified by the National Social Inclusion Commission within the national mechanism for promoting social inclusion in Romania. Active commitment by all stakeholders: central and local public authorities, public and private institutions, non-governmental organizations, religious institutions recognized by law, as well as community members set common goals, cooperate and mobilize all necessary resources for ensuring decent and dignified living conditions for vulnerable people. The Objectives, courses of action and countermeasures on poverty and social exclusion are assumed within local strategies development and community programs to combat poverty and social exclusion, approved by local council decision.

11.9.8. Annex 5.8. Deep analysis of document #8 of CS5

Table 118. Document #8 of CS5 Danube Delta deeply analysed

Case Study	**CS5 – Wetland Danube Delta (RO)**		
#8	**Climate change and environmental education in sustainable schools**		
Type of document	Other	**Language(s)**	Romanian
Scope	National	**Year of adoption**	2022
Web link	https://www.presidency.ro/ro/media/clima-si-sustenabilitate/raportul-educatia-privind-schimbarile-climatice-si-mediul-in-scoli-sustenabile	**Target year**	2030
Brief description	This report is a continuation of the Project "Educated Romania", initiated by the President of Romania, Klaus Iohannis, whose operationalization was included as a commitment in the National Defense Strategy for the period 2020-2024, and the strategic objectives and targets of the Project were assumed by the Government of Romania through the Memorandum.		
Sectors involved	Society		
Main target addressed	The document includes a series of concrete proposals, measures for the 2022-2030 horizon, which come to complete the environmental and climate education elements that currently exist in the national curriculum. Through the extensive involvement of social and institutional partners, the premises of an aggregate effort aimed at supporting and promoting the implementation of the measures advanced in the report were created.		
Other relevant objectives or strategies addressed			
O1	Climate and Environment Education Program		
O2	Solutions for educational resources		
O3	Infrastructure for sustainable schools		
O4	The human resource involved in climate change and environmental education		
Relevant policies and measures included			
P&M1	Orientation towards change and action, taking into account three dimensions: culture of complexity, capacity for action and co-responsibility towards the environment		
P&M2	The introduction of an additional week of School Otherwise, called Green Week; the development and expansion of optional courses on environmental protection for new beneficiaries; the wide adoption of good educational practices regarding the environment and climate already piloted by NGOs and certain schools; completing the school programs of geography, biology, chemistry, physics, etc. with notions of climate change and environment education; the initial and continuous training of teachers to be able to engage in formal and non-formal education on climate change and the environment; arranging/improving the learning environment, including the endowment related to the study of applied sciences, new technologies, in particular green technologies.		
P&M3	The report proposes a web platform dedicated to the centralization and accessibility of key resources for students and teachers that are useful in climate change and environmental education, as well as platforms that can support and stimulate student participation in actions dedicated to environmental protection. Within the platform, five distinct content areas are envisaged: • a. An area dedicated to environmental events or actions undertaken at local or national level, where each school/teacher can register with a group of students; • b. A digital library to centralize open educational resources: example lesson plans, exercises, presentations and activities (detailed on specific subject areas), teacher and student guides, quizzes, checklists, links to documentary films with free access, etc.; • c. An area dedicated to funding sources for educational/awareness activities on climate and environmental issues, for courses for teachers, for increasing the degree of sustainability of schools and reducing the carbon footprint;		

	• d. An area where partnership opportunities can be detailed, as well as a database of possible partners, at the level of some educational units in the country and outside it; • e. Databases of recommended places and available actors for undertaking outdoor activities.
P&M4	Creation of a database that will include protected natural areas, including in the urban environment, green areas around schools or in their interior, as well as urban and rural sustainable areas/objectives. Identifying external resources that can support outdoor education, nationally and at the individual school level.
P&M5	Supporting and rehabilitating pre-university education units in Romania, in order to increase their degree of sustainability; the development of sustainable school architecture; monitoring and evaluation of school buildings.
Actuation areas	National level (Romania).
Additional relevant information	The objectives are to be implemented by the Ministry of Education, Ministry of Agriculture and the Ministry of Environment, Water and Forestry, through the local entities

11.9.9. Annex 5.9. Deep analysis of document #9 of CS5

Table 119. Document #9 of CS5 Danube Delta deeply analysed

Case Study	**CS5 – Wetland Danube Delta (RO)**		
#9	**The strategy for the consolidation and development of the General Inspectorate for Emergency Situations for the period 2016-2025**		
Type of document	Law	**Language(s)**	Romanian
Scope	National	**Year of adoption**	2022
Web link	https://legislatie.just.ro/Public/DetaliiDocumentAfis/184895	**Target year**	2030
Brief description	The fundamental objective: Consolidation and development of the IGSU in order to increase the operational and response capacity, reduce the impact of the effects of emergency situations on the communities and improve the quality of the missions executed for the benefit of the population. In the field of emergency situations, Romania was affected by risks whose scale, intensity, frequency and mode of manifestation generated an important negative impact on social and economic development, requiring the allocation of substantial material, human and financial resources to restore normality. The manifestation of risks required a sequential study of them (an integrated analysis is being carried out through the National Disaster Risk Assessment Project - RO-RISK) which allowed the identification of 9 risks, grouped into 4 categories, with the following characteristics, each of them related to climate change effects: • fire risk: high frequency; affects important economic and social fields: constructions, installations, forests, means of transport, agricultural crops, etc.; • natural risks: repeatability, low predictability or unpredictability, with particular impact in terms of human and material losses; the need for complex means of intervention and a dynamic partnership; • technological risks: increasing frequency; special impact; complex and specialized means of response; • biological risks: cyclicity; unpredictability; large area of manifestation; important preventive and control measures.		
Sectors involved	Society		
Main target addressed (#1)	**Strengthening the role of authority in the field of emergency situations**		
Other relevant objectives or strategies addressed			
O1	Improving legislation in the field		
O2	Improving the capacity of law enforcement personnel		
O3	Improving the structures, standards and working procedures of the preventive inspection		

O4	Consolidation of market surveillance and approval and authorization activities
Relevant policies and measures included	
P&M1	Improving primary, secondary and tertiary legislation in the fields of fire protection and civil protection
P&M2	Respect and application by citizens, institutions and the private environment of the legal provisions in the field
P&M3	Updating approval and authorization procedures by eliminating unnecessary links
P&M4	Reducing the number of people and goods affected by emergency situations
P&M5	The promotion and application of new technologies that ensure the reduction of the impact of emergency situations
P&M6	The active involvement of operative personnel in law enforcement activity in the field of emergency prevention
P&M7	Creation and operationalization of the research component of the causes of fires
Main target addressed (#2)	**Strengthening the emergency preparedness capacity of the population, authorities, as well as private institutions and operators, especially those managing critical infrastructure**
Other relevant objectives or strategies addressed	
O5	Strengthening the activity of communication and preventive information
O6	Consolidation of the training activity of people with attributions in the management of emergency situations
O7	Strengthening the role of the institution responsible for training the staff of voluntary and private services for emergency situations, as well as the institution that approves the sector of competence and the endowment of voluntary and private services
O8	Taking over the responsibilities of alerting the population by modernizing and streamlining the integrated national notification-warning and alarming system
Relevant policies and measures included	
P&M8	Development of an integrated training concept
P&M9	The development of CNPPMSU and regional training centres, as well as the creation of new ones, depending on training needs and performances
P&M10	Development and provision of the national shelter fund
P&M11	Increased level of training and education of the population in the field of emergency situations
P&M12	Ensuring the training of decision-makers at the level of institutions and central and local public administration in terms of responsibilities, how to act in emergency situations and optimizing self-protection capacity
P&M13	Realization of an effective integrated national notification-warning and alarming system
P&M14	Consolidation of volunteering within the institution
P&M15	Improving the activity of voluntary and private services for emergency situations by ensuring the training and evaluation of personnel, as well as the approval of the sector of competence, the technique and the related logistic base
P&M16	Introducing new technological elements for fire detection and signalling in every public and private building
Main target addressed (#3)	**Strengthen and develop operational and response capacity**
Other relevant objectives or strategies addressed	
O9	Increasing integrated response capacity in emergency medical, fire and civil protection situations
O10	Implementation of new standards, operational procedures and modern technologies
O11	Developing the network of work points and increasing mobility

O12	Strengthening cooperation at national and international level
O13	Increasing the participation of volunteers in IGSU intervention teams
Relevant policies and measures included	
P&M17	Reduced response time
P&M18	Rapid adaptation to new types of emergencies that will arise
P&M19	Limited consequences of emergency situations (decrease in the number of victims and limitation of the affected heritage)
P&M20	Improving the information circuit and cooperation
P&M21	Active participation in international cooperation and assistance mechanisms
P&M22	Ensuring an adequate response in the event of a major disaster or multiple large-scale emergencies
P&M23	Increase response capacity by recruiting volunteers
Main target addressed (#4)	**Strengthen human, logistical and administrative capacity**
Other relevant objectives or strategies addressed	
O14	Improving the endowment with equipment and technical means, material goods and protective equipment adapted to all categories of missions
O15	Development of real estate and improvement of training, work, accommodation, storage and parking conditions
O16	Modernization of the communication system and information technology
O17	Improving HR policy for recruitment, selection, training and ensuring consistent and predictable career progression
O18	Consolidation and adaptation to international standards of the initial and continuous professional training system
O19	Promotion and application of performance-based management
O20	Development of public communication and information
Relevant policies and measures included	
P&M24	Increased degree of endowment with technical means and modern equipment to cover the needs for all types of risk and missions that the operative staff of the IGSU may face
P&M25	Expansion of real estate, improvement of working conditions, modernization of existing spaces and consolidation of buildings with high seismic risk
P&M26	Low staffing deficit of organizational states (below 5% for each category) and correction of the imbalance in the age structure of the staff
P&M27	High level of staff training and specialization, based on competences
P&M28	Modernized professional and continuous training system
P&M29	Work organization and efficient administrative procedures
P&M30	Effective public communication and information
P&M31	Communication system and information technology modernized in accordance with developments in the field
P&M32	ISO 9001 and CAF implemented at the level of IGSU and subordinate units
P&M33	Secured financial resources
Actuation areas	National level (Romania).

Additional relevant information	• Response time in emergency situations (urban, rural): 1. Extinguishing fires: – 8 minutes, in urban areas, in at least 90% of emergency cases; – 14 minutes, in rural areas, in at least 75% of emergency cases. 2. Provision of qualified first aid: – 6 minutes, in urban areas, in at least 90% of emergency cases; – 9 minutes, in rural areas, in at least 75% of emergency cases. 3. Emergency medical assistance in the pre-hospital: – 12 minutes, in urban areas, in at least 90% of emergency cases; – 15 minutes, in rural areas, in at least 75% of emergency cases. • The effectiveness of the legislative framework increased by adopting laws regarding the organization and operation of the institution, as well as the statutes of the military and volunteer firefighters; • High operational and response capacity; • Consolidated preparation and prevention system; • High degree of resilience of SNMSU structures and communities; • Prepared human resource and ensured work security; • The new technologies integrated in the activity of prevention, preparation and response (telemedicine system, drone units, emergency communication system for missions in tunnels/metro and in areas without coverage, etc.); • Centralized national notification-alarm system achieved by ensuring a 100% coverage of the county seat municipalities, 70% of the rest of the municipalities and 50% of the cities and communes on a national level; • High degree of trust in IGSU; • Reduced impact of assessed and treated risks.

11.9.10. Annex 5.10. Deep analysis of document #10 of CS5

Table 120. Document #10 of CS5 Danube Delta deeply analysed

Case Study	**CS5 – Wetland Danube Delta (RO)**		
#10	**The National Strategy regarding the Circular Economy**		
Type of document	Policy	**Language(s)**	Romanian
Scope	National	**Year of adoption**	2022
Web link	https://dezvoltaredurabila.gov.ro/strategia-nationala-privind-economia-circulara-prima-varianta-13409762	**Target year**	2030
Brief description	The general objective of SNEC in Romania is to provide the framework for the transition to EC, through the implementation of the Action Plan. The success indicator of this transition is the decoupling of economic development from the use of natural resources and environmental degradation. The overall objective of SNEC is closely linked to the SDGs of the UN 2030 Agenda and the global climate targets, as well as the new EU targets in the PAEC, in line with the principles and actions promoted under the Green Deal. At the national level, elements of the transition to EC in Romania are also provided in the National Strategy for the Sustainable Development of Romania 2030 – SNDDR 20301 and in PNRR2.		
Sectors involved	Finance/ Economy	Biodiversity and natural heritage	
Other relevant objectives or strategies addressed			
O1	Prioritizing local production over imported products and materials		
O2	Strengthening economic competitiveness and the labour force		

O3	Responsible and sustainable supply of raw materials
O4	Priority promotion of innovation and research in the field of circular economy
O5	Preservation, conservation and sustainable use of natural resources
O6	Prevention of waste generation and sustainable waste management
O7	Promoting responsible consumption and environmental education
O8	Protection of ecosystems and citizens' health
Relevant policies and measures included	
P&M1	Reducing the consumption of virgin raw materials through more sustainable extraction of raw materials and by recycling and recovery activities
P&M2	Reducing the consumption of consumer goods by extending the life of products: application of circular design and material efficiency; promoting dematerialization
P&M3	Reducing the impact of production activities on the environment by: o applying more innovative and greener technologies and processes; promoting digitization; favouring renewable energies at the expense of fossil fuels; exploiting the potential of industrial symbiosis.
P&M4	Reducing the environmental impact of waste and wastewater management and disposal activities by: promoting waste prevention; improving the waste management system and infrastructure; promoting waste sorting and treatment activities; limiting waste storage to a minimum.
P&M5	Improving policy coherence and governance, communication and collaboration between local, regional and national authorities.
Other relevant objectives or strategies addressed (TRANSVERSAL SECTORS)	
O9	**Waste Management** • Accelerating the process for all integrated waste management systems, SMIDs, to be fully operational at national level; • Ensuring an optimal infrastructure for waste collection, with a view to increasing separate collection of municipal waste, including door-to-door collection of separate waste; • Providing a financial incentive for separate collection through economic instruments, by increasing landfill fees or by prohibiting certain types of material from being classified as waste, if not appropriate, by introducing PAYT or deposit refund schemes for collection waste, by eco-modulating fees within the REP systems and ensure that citizens bear all the costs of managing residual municipal waste; • Enforcing composting legislation; • Ensuring research and development and investment in waste sorting and treatment facilities, including automatic waste sorting facilities, sorting of biodegradable and bio-based plastics, possible chemical recycling of plastics or textiles, biogas and composting plants; • Promoting education, raising awareness and informing citizens about the benefits and importance of separate collection, prevention and reuse of waste; • Creation of REP systems for: furniture, spare parts, building materials, textiles, etc.; • Developing a social and environmental responsibility of companies regarding responsible production and supporting them in the transition to a circular economy; • Development and training of skills necessary for circular processes.
O10	**Water Management- EU Commission 6R** strategy - reduce, reuse, recycle, recover, repair and restore to keep water circulating for longer and reduce the burden on natural systems. Improving sludge management from sewage treatment plants, gradually increasing the amount that is recycled to agriculture. This also includes the promotion of biogas production from wastewater treatment plants. The consumption of drinking water "from the tap" should be promoted, compared to bottled water. The use of water for urban consumption today offers a high degree of safety for human health.
Actuation areas	National level (Romania).

Additional relevant information	A coherent governance structure is crucial for the successful implementation of the SNEC and its follow-up actions. The current governance model is in transition, with new structures and dynamics taking shape. In an effort to contribute to the EC transition process, an EC governance structure will be established in Romania that will clearly define the roles and responsibilities of the institutions involved. This will include a coordination structure, managed at the centre of Government, and an executive structure, established within all ministries dealing with EC-related activities. This strategy will be completed by an Action Plan that will include specific actions for sectors with high potential for circularity, will identify budgetary resources, responsible and deadlines for carrying out the actions. Based on the preliminary analysis, which takes into account the economic contribution, the environmental impact, as well as the challenges and opportunities in each economic sector, it can be concluded that the improvement of the circular economy has the greatest potential in the following sectors: • Agriculture and forestry; • Automotive industry; • Constructions; • Consumer goods such as food and beverages; • Packaging such as: glass, paper, plastic materials, etc.; • Textiles; • EEE.

11.9.11. Annex 5.11. Deep analysis of document #11 of CS5

Table 121. Document #11 of CS5 Danube Delta deeply analysed

Case Study	**CS5 – Wetland Danube Delta (RO)**		
#11	**Strategy for sustainable transport for the period 2020-2030**		
Type of document	Strategy	**Language(s)**	Romanian
Scope	National	**Year of adoption**	2008, updated in 2019
Web link	https://www.mt.ro/web14/documente/strategie/strategii_sectoriale/strategie_dezvoltare_durabila_noua_ultima_forma.pdf	**Target year**	2030
Brief description	The general objective is the balanced development of the national transport system that ensures a modern and sustainable transport infrastructure and services, the sustainable development of the economy and the improvement of the quality of life. Achieving this objective will contribute directly to ensuring the sustainable development of the transport sector, the economy and the environment, to increasing the degree of accessibility of Romania, ensuring the inter-modality of the transport system, promoting the balanced development of all modes of transport and improving the quality and efficiency of services.		
Sectors involved	Transport		
Other relevant objectives or strategies addressed			
O1	Modernization and development of the transport network of European and national interest, increasing safety conditions and quality of services		
O2	Increasing competitiveness in the transport sector		
O3	Liberalization of the internal transport market. Ensuring the legislative/normative/institutional framework for the implementation of community legislation and harmonization in domain: increasing and diversifying the offer of goods transport (20% - 40%) and service quality (25% - 45%)		
O4	Stimulating the development of the economy and competitiveness		
O5	Compatibility with the environment		

O6	Strengthening social and territorial cohesion at regional and national level
Relevant policies and measures included	
P&M1	Reduction of specific energy consumption/cal km, t km (10% - 20%)
P&M2	Increasing the degree of use of research and development results and innovation (40% - 60%)
P&M3	Reducing the global impacts of transport (fitting into the objectives set for Romania regarding the National Emission Ceilings) and the impact on the environment (5% - 20%)
P&M4	Reducing the current exceedances of air quality limit levels in cities and for pollutants where transport is the main source of pollution (5% - 15%)
Actuation areas	National level (Romania).
Additional relevant information	Organizations that implement the strategy: https://www.mt.ro/web14/despre-noi/organizare/companii-mt/145-unitati-sub-autoritatea-m-t

11.10. Annex 10. Case Study 5 – Wetland (Tulcea): PESTLE results for the local ecosystem drivers' analysis

The Danube Delta Case Study did realize the three PESTLE activities. The first one took place during the physical consortium meeting in Sitia, where the inputs of that can be seen in following Figure 209. In that exercise, the PESTLE was done in a broader way, not only to consider the drivers (as positive things already in place) also including challenges, which serve as basis for the goal definition in the last exercise from this PESTLE activity.

Figure 209. Danube Delta PESTLE analysis of local ecosystem drivers (activity during Sitia project meeting)

Then, a contrast exercise was performed by the Local Council of Stakeholders, from which the following outcomes (Table 122) were obtained.

Table 122. Danube Delta PESTLE analysis of local ecosystem drivers – input from Local Council Stakeholders

Danube Delta CS POLITICAL local drivers
Urban plan that promotes the development of new infrastructures
Land-use plan that protects natural- heritage areas and protected areas
The presence of local actors with expertise in energy efficient technologies, on research and innovation and on climate change adaptation
The Integrated Strategy for the Sustainable Development of the Danube Delta; urban plans that take into consideration the NATURE 2000 regulations
Danube Delta CS ECONOMIC local drivers
Investors in renewable energy systems
Financial institutions interested to invest in climate change adaptation projects
Access infrastructure, for example: Tulcea - Braila Bridge; Area is prone to ecological agriculture and agro-tourism; stone quarries and gas connection; electricity renewable sources
Danube Delta CS SOCIAL local drivers
Local public initiatives to decarbonize the transport system

Infrastructure suitable for electric cars in terms of battery charging systems
Promoting a healthy lifestyle and the well-being of the general population through information and education
Multiculturality, ethnic harmony, low density; the existence of historical vestiges, many annual festivals; intense cultural activity
Danube Delta CS TECHNICAL local drivers
Local actors with a focus on research and innovation activities (research and innovation) on climate change adaptation/mitigation
Local stakeholders working on innovative solutions for climate change adaptation/mitigation
Electric energy from renewable sources; the presence of the Danube Delta Research and Development Institute; the existence of the industrial platform; proximity to the Technical University Centre in Galati
Danube Delta CS LEGAL local drivers
Protected areas with a specific legal framework of the territory
Legislation in force for gender equality and non-discrimination
Legislation that requires an environmental impact assessment to be carried out on the activity and that supports the conservation of protected areas and the protection of the environment
Administrative decentralization; the existence of institutions with specific regulations
The existence of institutions with inspection, approval and control competences
Danube Delta CS ENVIRONMENTAL local drivers
Increasing the efficiency of solar production in photovoltaic panels (more hours without clouds)
Increasing the efficiency of solar production in photovoltaic panels (more hours without clouds) and as many sunny days as possible
Approved project for the protection, conservation and further development of a forest in the area, which will contribute to adaptation to climate change, improve air quality and other associated benefits
The presence of regulatory and control institutions in the field of environmental protection both on the terrace side and on the wetland area, 80% of the territory included in NATURA 2000; Danube Delta UNESCO site

All in all, a final exercise gathering inputs and collective feedback around the different drivers around each aspect was done, with a prior reflection on the case study vulnerable sectors, challenges and goals to overcome those challenges (Table 123), in order to set the basis for the final brainstorm on local drivers that can facilitate or enable the design and deployment of different policies at the case study.

Table 123. Danube Delta CS analysis of challenges and goals related to CS vulnerable sectors to serve as basis for the PESTLE analysis of local ecosystem drivers

DANUBE DELTA VULNERABLE SECTORS
Agriculture, forestry and fishing
Energy
Water and waste
Tourism, leisure and cultural heritage
Industry and commerce
CHALLENGES (mainly related with the vulnerable sectors)
Depopulation of the region
Lack of public investment in the new technologies
Frequent manifestation of the weather on all extremes: heat/freeze, flood/drought
Biodiversity risks
Undiversified accessibility modes- air transport and railroads almost miss as options
Decreasing number of qualified workers
Climate change unaware population
Lack of public investment in flood prevention (hydrotechnical infrastructure)
Inflexible administration and decision-making practices

Insufficient promotion of the archaeological and local identity
Lack of free data
GOALS (to overcome the challenges)
Implement policies to diversify the job offer in the region
Increase public investment in new technologies
Increase resilience for extreme weather
Integrate more natural areas in the urban zones
Increase investment in the air and rail transportation means
Develop and integrate climate change curriculum
Better prioritization of the public funds- towards sustainable, preventive and added value investment
Incorporate more scientific data in the decision-making flow
Increase number of public private partnership to promote cultural and historical sites

The following Table 124 concludes with the final outcomes of the PESTLE analysis performed for the Danube Delta case study, considering also all previous inputs from the other activities as well as the basis of the vulnerable sectors, challenges and goals.

Table 124. PESTLE analysis of local drivers of Danube Delta Case Study (final activity)

POLITICAL DANUBE DELTA CS local drivers
Local and regional sustainable strategies
All regions in Romania, including Tulcea county are supporters of the EU
EU protected local gastronomic products (smoked Danube mackerel, pike roe salad and Dobruja pie)
Local authorities interested to access European funding to develop local strategies- climate change including
Existence of association forms between local authorities
Policies that support preservation of the wild beaches and virgin forests
ECONOMIC DANUBE DELTA CS local drivers
National and local policies in real estate
Flexibility of the market towards new opportunities- proven during the COVID -19 pandemic and the African pest epidemic
Integrated Territorial Investment Instrument for local funded actions for ecological business models
National policies successfully transposed on local level that support individual energy independence from renewable sources
SOCIAL DANUBE DELTA CS local drivers
Capitalization of the local ethnical mosaic and environment initiatives in cultural actions - ethnic and green film/theatre/music events
Public partnerships with the local eco-museum network to promote green practices
People are more dedicated to sanction bad environmental practices
Growing number of green initiatives funded by the participatory governance instruments
Increased interest of the general community for healthy and wellness practices
No-Car Fridays- green initiatives for the administration and business sector
Immigrant workers in industry and tourism sector
Social inclusion strategy for all vulnerable categories
TECHNICAL DANUBE DELTA CS local drivers
Danube Delta National Institute with great public campaigns that promote new technologies, environmental studies and climate change solution
Increased interest of the general population for the IT&C solutions proposed by the local administration
Close presence of the renewable source energy production
Highly qualified work forces and logistics in agriculture
LEGAL DANUBE DELTA CS local drivers
Specific legislation for protected areas

Legislation in force for gender equality and non-discrimination
Risk assessment and intervention plans updated
Legal control of all the acts emitted by the local authorities
Consumer rights-oriented law enforcement
Access permits in the protection areas
Legislation regarding hunting and fishing periods
ENVIRONMENTAL DANUBE DELTA CS local drivers
Favourable area for renewable energy, especially wind and solar
Capitalize the warmer winters that allow exotic birds to remain during the cold season in the region
Iconic natural landscapes

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This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101056858.