ADAPTATION MEASURES 6

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Based on the above diagnosis, and with the participation of citizens and the collaboration of experts and people with technical and institutional responsibilities, a set of measures have been designed to enable Santander to achieve its adaptation objectives. These measures are grouped into four fundamental adaptation goals: Resilient City, Biodiversity, Health, and Adapted Society and Economy.

6.1 CRITERIA FOR THE SELECTION OF MEASURES

Given the need to promote adaptation measures that respond to the possible impacts derived from climate variability, and assuming the difficulty of reducing greenhouse gas emissions in the short term, the Adaptation Plan is articulated as the tool for transformation towards adaptation. According to the summary of the AR6 Synthesis Report for policy makers (IPCC, 2022b), this 'transformative' capacity occurs with measures that prioritise equity, social justice, climate justice, rights-based approaches and inclusiveness. It is such measures that lead to more sustainable outcomes, reduce trade-offs and promote climate-resilient development.

At this stage of defining adaptation measures, and in line with the 'Guidelines on Member States' adaptation strategies and plans, the measures of the Santander Adaptation Plan have been defined by following the recommendations set out in its Annex II (Unión Europea, 2023):

- **Just resilience:** The most vulnerable groups in society are often most affected by climate change, so climate change impact and vulnerability assessments must pay attention to the disproportionate consequences for disadvantaged groups of people and geographic areas. To achieve fair resilience, it is essential to avoid unequal burdens and to leave no one behind.

  With this in mind, the Santander Adaptation Plan has identified vulnerable groups at the census section level and defined risk levels for each hazard from different perspectives, gender, age groups, and socio-economic inequality. The analysis of the various sensitivity indicators has made it possible to establish measures focused on generating a more adapted and safer society.

- **Maladaptation:** All adaptation work takes place in a constantly changing context and is associated with a high level of uncertainty. Adaptation is, therefore, a continuous process whose outcomes are difficult to predict. In some cases, adaptation efforts can result in unintended and undesirable negative consequences, referred to as 'maladaptations'. The adaptation measures outlined in this plan have been reviewed and evaluated from a 'maladaptation' perspective, identifying further problems in their implementation. Understanding the causes of vulnerability and the impacts derived from exposure, despite the degree of uncertainty, allows for a high degree of effectiveness of the measures. As a methodological advance, the Santander Adaptation Plan projects risk to the hypothetical conditions of the city for the long-term horizon, so the degree of uncertainty is significantly reduced.
- **Nature-based solutions:** The European Green Deal in general, and EU adaptation and biodiversity policies in particular, call for greater efforts to implement nature-based solutions much faster and on a much larger scale than is currently the case.

  The Adaptation Plan addresses a range of measures focusing on the guidelines set out in the communication: conservation and restoration (including renaturation); sustainable management of green infrastructure; and creation of new ecosystems designed for specific adaptation needs (such as green roofs or hybrid solutions for coastal management).
- **Climatic endurance tests:** Climate resistance testing detects potential risks in a specific area arising from hazards related to climate events. The tests are carried out by collecting and creating information on the effects of climate change (the element to be made resilient) and on the vulnerability of systems and objects to such effects.

  The exhaustive analysis of the threats, exposure and social, economic and environmental sensitivity of Santander guarantees the contribution of basic information that has been contrasted in the different debates developed in the participatory workshops. The exchange of information between the various entities participating in the consultative process and the contributions of different citizen groups have allowed us to assess the climate resilience of the different actions proposed.

The **characteristics of the measures** designed for Santander, in addition to meeting the adaptation criteria mentioned above, are aligned with the different institutional frameworks reviewed in the introductory chapter, and meet the following requirements.

- Measures that can be implemented in the **short and medium terms**, executable in periods not exceeding 10 years. However, some of the measures can be developed in longer periods due to their technical or managerial complexity.

- Focused on **strengthening adaptive capacity**, improving local understanding and preparedness, implementing training capacities, as well as ensuring an effective response to climate change through concrete actions.
- Measures with proven **environmental, economic and social benefits** that outweigh the cost of implementation.
- Measures with **relatively low costs**, although given that their benefits can be significant, they can be implemented assuming a certain degree of uncertainty in effectiveness.
- **Flexible or reversible** measures that do not imply a drastic break with the existing situation and can be improved over time with technological advances or new capabilities.

Taking these aspects into account, measures are contemplated that respond to the different typologies, which can be grouped under the different headings:

- **Soft or adaptive capacity measures:** Strengthen adaptive capacity. They support the improvement of risk management (both with advances in the understanding of the phenomenon, as well as in risk management or training issues).
- **'Green' adaptation measures based on ecosystems and green infrastructure:** Specific actions based on ecosystems and green infrastructure that increase urban resilience.
- **Hard or gray infrastructure measures:** Engineering works that minimise the effects of risk.
- **Hybrid measures or solutions (green + gray):** Combination of engineering works with green measures based on ecosystems or green infrastructure.

Following these criteria, the methodology discussed below has been proposed for the selection and prioritisation of Santander's adaptation measures.

6.2
METHODOLOGY FOR SELECTION AND PRIORITISATION OF MEASURES

In line with the European Union Communication on Adaptation Plans (2023), the following methodology has been structured in two fundamental phases: First, with the definition of adaptation options and the creation of a portfolio of options; and then moving on to the participatory phase of co-assessment and prioritisation of adaptation options.

Adaptation Options

Based on the risk assessment, taking into consideration the hazards, their exposure and the sensitivity associated with them, the process of identifying specific measures to address all of the identified phenomena began. To this end, the drafting team made a long proposal of measures selected from an exhaustive bibliographic review of various Spanish local plans in similar situations and configuration, and a set of international examples of interest to Santander. In addition, the diagnosis of local exposure and vulnerability conditions allowed the identification of concrete measures that at the municipal and neighbourrhood level can reduce the level of risk. In this phase, a total of 558 measures were grouped by the lines of action related to the impacts, according to table 6.1:

TABLE 6.1. *Long list of measures*

LINES OF ACTION	N.º MEASURES	LINES OF ACTION	N.º MEASURES
Human Health	20	Education and Society	64
Natural Heritage and Biodiversity	52	Primary Sector	31
Water and Water Resources	57	Industry	11
City, Urbanism, Building	73	Finance and Insurance	16
Coasts and Marine Environment	19	Social Cohesion	5
Climate and Climate Scenarios	28	Mobility and Transport	66
Energy	55	Cultural Heritage	16
Tourism	6	Transversal; Other	39

Source: CINCc (UC) - FIC, 2024.

With this broad spectrum of adaptation options, an adjusted list of specific measures was defined and evaluated for the specific case of Santander. As with the first long list of options, this group of measures was structured along the following lines of action:

A prioritisation process under expert criteria reduced the number of adaptation measures to a total of 215. This prioritisation, through a quantitative assessment of each measure between 0 and 10 points, was carried out by the drafting team, experts in the scientific field and staff of the technical team of the City Council of Santander. Subsequently, the set of pre-selected measures was contrasted with citizens and risk experts during four participatory workshops where 88 measures were grouped into adaptation goals and objectives. Finally, the set of measures selected and prioritised for Santander was reduced to 85 actions distributed across four major goals and ordered according to the degree of priority given in the participatory process.

TABLE 6.2. *Adjusted list of specific measures*

LINES OF ACTION	N.° MEASURES	LINES OF ACTION	N.° MEASURES
Human Health	14	Education and Society	22
Natural Heritage and Biodiversity	25	Primary Sector	8
Water and Water Resources	26	Industry	5
City, Urbanism, Building	34	Finance and Insurance	6
Coasts and Marine Environment	11	Social Cohesion	2
Climate and Climate Scenarios	16	Mobility and Transport	17
Energy	18	Cultural Heritage	5
Tourism	5	Transversal; Other	1

Source: CINCc (UC) - FIC, 2024.

The four goals that group the set of measures together reflect the principles and strategies defined in the policy framework and cover the broad spectrum of adaptation solutions required: **Biodiversity; Resilient City; Adapted Health;** and **Adapted Society and Economy**. For each goal, a series of adaptation objectives have been established, with the design of a corresponding set of measures.

TABLE 6.3. *Validated List of Goals, Objectives and Measures*

GOALS	N.° OF OBJETCTIVES	N.° OF MEASURES
Biodiversity	3	11
Resilient City	7	31
Health	4	20
Adapted Society and Economy	6	23

Source: CINCc (UC) - FIC, 2024.

The information for the development of a subsequent Action Plan for each of these measures is included in an **individual sheet**. Each sheet includes information on the type of measure, the threats to which it responds, the territorial scope of the action, the mission of each of these measures, the level of priority of the action, including its quantitative assessment and, finally, the follow-up indicators that allow the degree of achievement of the goals to be evaluated.

6.3

GOALS, OBJECTIVES AND MEASURES

The measures designed respond to the adaptation objectives necessary for the fulfillment of the four major goals that lie ahead for Santander to become a resilient city.

BIODIVERSITY

The Biodiversity Goal focuses on fostering a resilient green infrastructure adapted to the future climate, while favouring biodiversity and enhancing ecosystem services. Factors that should encompass several fundamental aspects to ensure its effectiveness and long-term sustainability include the following:

1. **Conservation and Ecological Restoration:** The goal prioritises the conservation of existing natural habitats and the restoration of degraded areas. The goal is not only to protect areas of high biodiversity value but also to connect habitat fragments to form ecological corridors that allow for the movement and adaptation of species in the face of climate change.
2. **Design and Planning of an Integrated Green Infrastructure:** Green infrastructure will contribute to integration with the urban environment, promoting the multifunctionality of spaces. This includes the creation of urban parks, community gardens, and the implementation of green roofs and façades. Green infrastructure should be designed to maximise carbon sequestration, improve stormwater management, and promote ecological connectivity.
3. **Adaptation to Climate Change:** Green infrastructure must be resilient to the impacts of climate change. It is, therefore, necessary to consider future climate change scenarios in the planning and management of these areas, ensuring that they can withstand and recover from extreme events such as floods, heat waves, and droughts. The selection of plant species should be strategic, prioritising those that are native and resilient.
4. **Ecosystem Services Enhancement:** The goal recognises and enhances the ecosystem services that green infrastructure provides, such as climate regulation, biodiversity support, mental and physical health benefits for people.
5. **Community Involvement and Awareness:** Community participation in planning, stewardship, and maintenance of green infrastructure needs to be encouraged.
6. **Monitoring and Evaluation:** A monitoring and evaluation system should be established to measure the effectiveness of implemented actions.

By addressing these aspects, the Biodiversity Target can effectively guide the transition to a resilient and biodiverse city, creating systems that not only support local flora and fauna, but also benefit Santander society and contribute to climate change mitigation and adaptation.

OBJECTIVES

B1 Promote biodiversity and soil quality for greater urban resilience.

B2 Make urban green infrastructure an ally against climate change impacts.

B3 Ensure the participation of society in the management of green infrastructure in the face of climate change.

Objective B.1: **Promoting biodiversity and soil quality for greater urban resilience**

Promoting biodiversity and soil quality in urban areas is essential for building cities that are more resilient to the challenges of climate change and environmental degradation. An effective strategy to achieve this is the renaturation of paved surfaces, transforming them into green areas that increase soil permeability and promote biodiversity. This not only improves water management, preventing urban flooding through the natural absorption and filtration of rainwater, but also contributes to the creation of habitats for various species.

Excessive paving in cities limits the soil's ability to absorb and filter water, exacerbating runoff problems and increasing the risk of flooding. Renaturalising these areas by reintroducing high quality soils and vegetation improves soil infiltration capacity, recharges the subway aquifer, and improves water quality through natural filtration processes.

Urban green areas are vital for biodiversity, providing habitats for insects, birds and small mammals. The selection of native plants in these renaturation projects, with control of invasive species, is key to providing food and shelter for local wildlife, contributing to biodiversity conservation. These areas not only enrich the urban landscape, but also provide essential ecosystem services, such as climate regulation, carbon sequestration and air quality improvement.

Implementing renaturation measures requires careful planning and collaboration between different stakeholders, including the City Council, communities and environmental experts. It is also essential to integrate these green spaces into the urban fabric so that they are accessible to all citizens, thus providing additional social benefits such as recreational and wellness spaces.

Five adaptation measures are included in this objective:

B1.1 Greening paved surfaces
B1.2 Renaturalisation of private areas
B1.3 Control of invasive species
B1.4 Renaturalisation of river corridors
B1.5 Demonstrative actions and promotion of Nature-based solutions

Greening paved surfaces

B1.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Constructive	Heat waves, pluvial flooding	Municipal

MISSION OF THIS MEASURE

Renaturalise large paved areas by increasing the permeability of soils with the provision of high quality soils for the promotion of biodiversity.

FIGURE B1.1. Impermeable public spaces

Source: CINCc (UC) - FIC, 2024

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,38

FOR MORE INFORMATION

Reference: Un país para renaturalizarlo. (Equipo EYS Municipales, 2022)
More information at: https://www.eysmunicipales.es/articulos/un-pais-para-renaturalizarlo

MONITORING INDICATORS

Percentage of permeable surface area / Municipal surface area
Percentage of permeable surface of open spaces / Total surface of open spaces

Renaturalisation of private areas

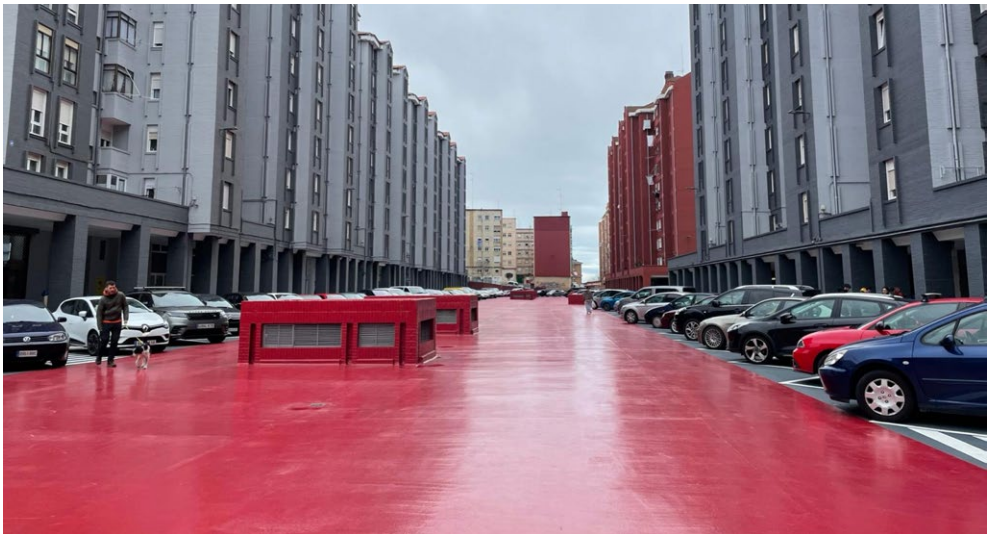
B1.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Nature-based solutions	Heat waves, pluvial flooding	Neighbourhood

MISSION OF THIS MEASURE

Greening the urban environment in the common spaces between blocks and block courtyards.

FIGURE B1.2. Sector with high artificialisation (C/ Blas Cabrera, Santander)



Source: CINCc (UC) - FIC, 2024

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,31

FOR MORE INFORMATION

Reference: Plan municipal del Valle de Egüés. (Ayuntamiento del Valle de Egüés, 2024).
More information at: https://www.valledeegues.com/recurso_turistico_cp/sarriguren/

MONITORING INDICATORS

Percentage of surface area of private green areas / Surface area of public open spaces
Percentage of green areas in private spaces / Private non-built-up areas

Control of invasive species

B1.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Nature-based solutions	Heat waves, wind / Derived threats - disease vectors	Municipal

MISSION OF THIS MEASURE

Control and eradicate invasive species by generating a comprehensive system of data collection and species evolution.

FIGURE B1.3. Specimen of Plumero, invasive alien species in Santander

Source: CINCc (UC) - FIC, 2024

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,38

FOR MORE INFORMATION

Reference: Proyecto para la eliminación del Plumero de Pampa en la Mancomunidad de Servicios de Uribe Kosta (SOPELA, 2023)

More information at: https://sopela.eus/areas-municipales/sostenibilidad/proyecto-para-la-eliminacion-del-plumero-de-pampa-en-la-mancomunidad-de-servicios-de-uribe-kosta/

MONITORING INDICATORS

Percentage of surface area with degraded areas / Municipal surface area

Number of invasive alien species per hectare

Renaturalisation of river corridors

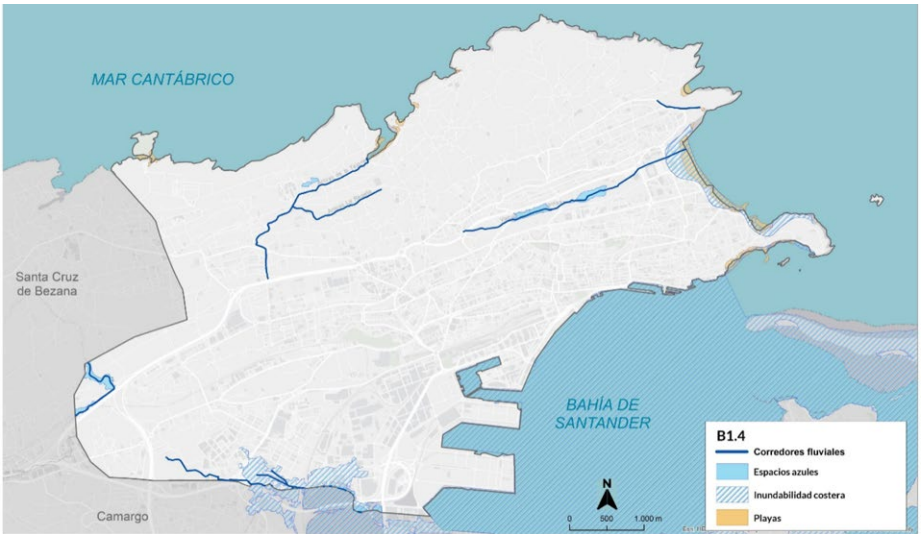
B1.4

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Nature-based solutions	Heat waves, drought, pluvial flooding	Punctual

MISSION OF THIS MEASURE

Renaturalise river corridors, such as the Arroyo Otero river corridor, removing any barriers to water and biological flow. Increase the renaturation of the municipality's minor streams (Tejona, Regata and Molinucos) and the Raos Canal.

FIGURE B1.4. River corridors, water bodies and areas affected by coastal flooding



Source: CINCc (UC) - FIC, 2024 based on data from PEMUSAN (2016)

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,23

FOR MORE INFORMATION

Reference: Estrategia para la restauración y renaturalización de los ecosistemas fluviales en el Término Municipal de Loja y la reducción del riesgo de inundación del entorno urbano del río Genil a su paso por Loja (Paseo del Genil).

More information at: https://fundacion-biodiversidad.es/.

MONITORING INDICATORS

River corridors and water bodies naturalised, created or restored (No., m^2)

Surface area of Blue Infrastructure / Municipal surface area

Demonstrative actions and promotion of NbS B1.5

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Education	Heat waves, drought, pluvial flooding, coastal flooding, wind	Neighbourhood

MISSION OF THIS MEASURE

Demonstrate actions to increase biodiversity and public green infrastructure for replication in private spaces.

FIGURE B1.5. Subida al Gurugú vertical garden

Source: CINCc (UC) - FIC, 2024

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 6,85

FOR MORE INFORMATION

Reference: High Line, Nueva York, Estados Unidos. (Friends of the high line, 2024)
More information at: https://www.thehighline.org/about/

MONITORING INDICATORS

No. of demonstration actions of NbS solutions
No. of communication and awareness-raising projects
No. of knowledge transfer activities

Objective B.2: Making urban green infrastructure an ally in the face of climate change impacts

Transforming urban green infrastructure into a key ally against climate change impacts is an appropriate strategy to increase urban resilience. This adaptation involves several innovative measures that harmonise urban spaces with the natural environment, fostering a sustainable and resilient coexistence.

Climate change-adapted revegetation is the first step towards this goal with the selection and planting of native and resilient species, capable of surviving and thriving under the new climatic conditions. This practice not only enhances urban biodiversity, providing habitats for a wide range of species, but also improves air quality and provides green spaces for community recreation.

Incorporating nature-based solutions (NBS) for coastal protection is another vital measure, especially in urban areas vulnerable to erosion and sea level rise. Techniques such as shoreline restoration, erosion protection, introduction of native species for wave protection not only protect coastlines from physical impacts, but also support biodiversity and boost the local economy through tourism and fisheries.

New methodologies for adaptive landscaping include designing green spaces that require less maintenance and resources, opting for drought-tolerant plants and efficient irrigation systems that minimise water use. This approach reduces the demand for potable water for irrigation and promotes the sustainable use of water resources.

Water harvesting strategies for urban landscaping, such as rainwater capture and reuse, are essential. These systems not only reduce pressure on municipal water supplies, but also contribute to sustainable stormwater management, reducing runoff and flood risk.

Each of these measures contributes to creating an urban green infrastructure that not only addresses the challenges of climate change, but also promotes a healthier, more biodiverse and pleasant environment for urban living. Objective B.2 consist of the following four adaptation measures:

B2.1 Climate change-adapted revegetation
B2.2 Incorporation of NbS for coastal protection
B2.3 New methodologies for an adapted gardening
B2.4 Water harvesting strategies for urban landscaping

Climate change-adapted revegetation B2.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Nature-based solutions	Heat waves, drought, wind	Municipal

MISSION OF THIS MEASURE

Plant species adapted to climate change from the catalogue validated by the Plan and monitoring of their evolution.

FIGURE B2.1. Climate-adapted planting strategies, Calle Tetuán, Santander

Source: CINCc (UC) - FIC, 2024

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 9,23

FOR MORE INFORMATION

Reference: Adapta Biofilia (Diputación de Badajoz, 2024)
More information at: https://transicionecologica.dip-badajoz.es/proyecto/adapta-biofilia

MONITORING INDICATORS

Percentage of species adapted to the future climate / Total municipal catalogue of species

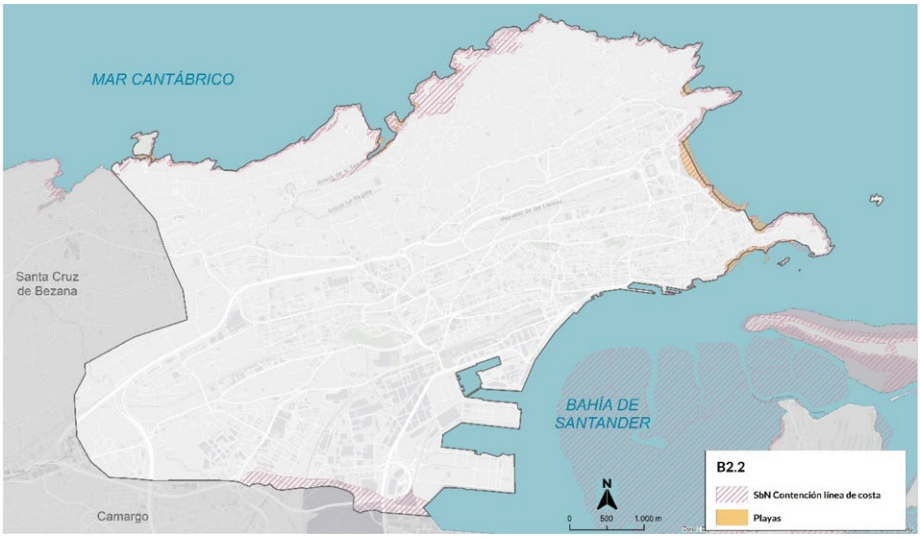
Incorporation of NbS for coastal protection B2.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Nature-based solutions	Coastal flooding	Punctual

MISSION OF THIS MEASURE

Incorporate nature-based solutions for the containment of the coastline, especially beaches, reinforcing dune systems and marine ecosystems, and avoiding intervention through protective infrastructures with impacts on the landscape and coastal heritage.

FIGURE B2.2. Zoning for the implementation of NBS for coastal protection



Source: CINCc (UC) - FIC, 2024 based on data from PEMUSAN 2016

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 9,15

FOR MORE INFORMATION

Reference: Nature-based solutions frente al cambio climático: restauración de dunas y marismas (Uhina, B. 2020)

More information at: https://www.ehu.eus/cdsea/web/wp-content/uploads/2017/03/Articulos_Uhina_bea2020.pdf

MONITORING INDICATORS

Length (m) (km) of urban green infrastructure for coastal protection

New methodologies for an adapted gardening B2.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, drought, wind	Municipal

MISSION OF THIS MEASURE

Adapt current gardening practices to future climatic conditions (maintenance, planting of species.).

FIGURE B2.3. Supervision of new plantations in the framework of the Santander Capital Natural project

Source: SEO/BirdLife, 2024

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,38

FOR MORE INFORMATION

Reference: Nuevos pasos para adaptar la jardinería municipal al cambio climático (Eldiarioex, 2023)
More information at: https://www.eldiario.es/extremadura/sociedad/nuevos-adaptar-jardineria-municipalclimatico_1_1720721.html

MONITORING INDICATORS

Annual volume of water reused in municipal irrigation
Percentage of adapted species / Total number of species in municipal catalogue

Water harvesting strategies for urban landscaping

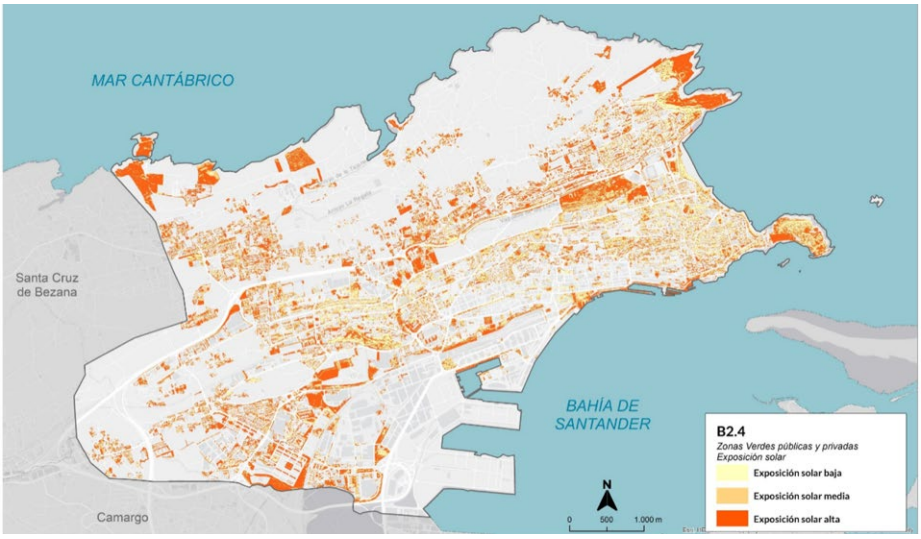
B2.4

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Nature-based solutions	Pluvial flooding, drought, heat waves	Punctual

MISSION OF THIS MEASURE

New plantings in climate-protected areas, shaded, shaded beds or predominantly inorganic mulches to maximise rainwater harvesting and avoid loss through evapotranspiration.

FIGURE B2.4. Solar exposure of public and private green spaces



Source: CINCc (UC) - FIC, 2024

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 6,38

FOR MORE INFORMATION

Reference: Las 10 ciudades más sostenibles: Lideres en prácticas de Management del agua. (Tappwater, 2023).

More information at: https://tappwater.co/es/blogs/blog/10-ciudades-mas-sostenibles-gestion-del-agua

MONITORING INDICATORS

Annual volume (m^3) of rainwater collected and stored

Annual volume (m^3) of water reused for municipal irrigation / Annual volume (m^3) municipal irrigation water

Objective B.3: Ensuring society's participation in the management of green infrastructure in the face of climate change

Ensuring the participation of society in the management of green infrastructure effectively addresses the challenges of climate change, especially with regard to the conservation of coastal areas and marine biodiversity, as well as the stewardship of natural areas. This collective participation not only fosters greater environmental awareness and responsibility among citizens, but also ensures that conservation strategies are more inclusive, sustainable and tailored to local needs and values.

The conservation of coastal spaces and the protection of marine biodiversity require a collaborative approach, where local communities, non-governmental organisations, businesses and governments work together to develop and implement management plans that promote the resilience of these ecosystems. The active participation of society can take many forms, from involvement in beach clean-ups and natural shoreline restoration, e.g., coastal oak groves, to involvement in citizen science projects that monitor the health of marine ecosystems. These actions not only contribute to environmental conservation, but also strengthen community ties and promote a sense of ownership and responsibility towards natural resources.

On the other hand, wilderness stewardship involves the management and protection of these areas by the local community, in collaboration with landowners and environmental authorities. This conservation model allows citizens to participate directly in the protection of their environment, adopting sustainable land use practices, habitat restoration and prevention of invasive species. Land stewardship encourages a more decentralised management adapted to the specific characteristics of each natural area, ensuring that conservation measures are effective and supported by the community.

Encouraging citizen participation in the management of green infrastructure and nature conservation is essential to create a more resilient and environmentally engaged society. Through environmental education, volunteerism and community collaboration, effective strategies can be developed to respond to the challenges of climate change, protecting and restoring our valuable ecosystems for future generations.

Two main adaptation measures are defined in Objective B.3:

B3.1 Conservation of coastal areas and marine biodiversity

B3.2 Stewardship of natural areas

Conservation of coastal areas and marine biodiversity

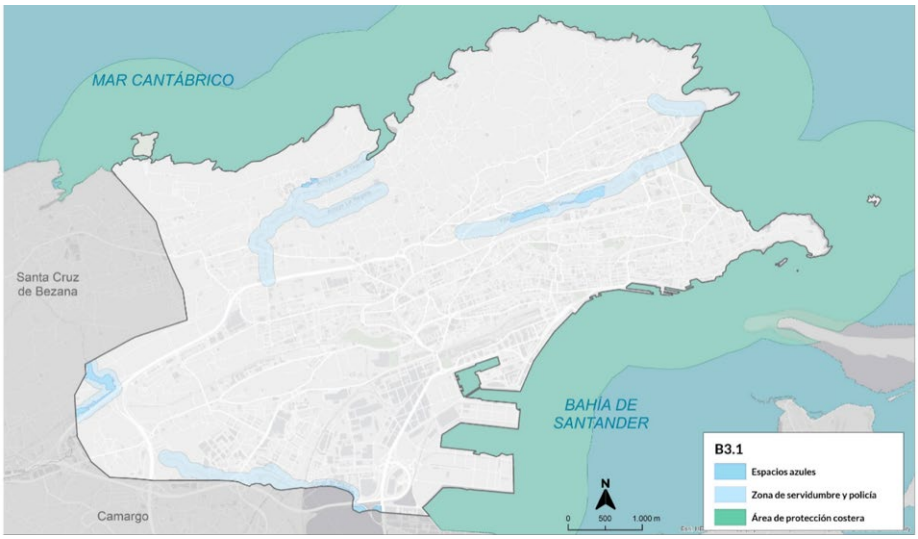
B3.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Nature-based solutions	Coastal flooding, pluvial flooding, heat waves	Punctual

MISSION OF THIS MEASURE

Create a programme for the conservation, environmental quality and sustainable use of blue spaces, as well as programmes to increase and monitor marine biodiversity in the immediate coastal strip in coordination with competent coastal administrations.

FIGURE B3.1. Areas susceptible to conservation of coastal areas



Source: CINCc (UC) - FIC, 2024

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,92

FOR MORE INFORMATION

Reference: Programa LIFE Intemares. (Life Intemares, 2024)
More information at: https://intemares.es/en/

MONITORING INDICATORS

Area (m^2) of coastal space threatened by loss of biodiversity
Area (m^2) with coastal and marine restoration projects
Identification of discharges and effluents (no.) on the coastline

Stewardship of natural areas

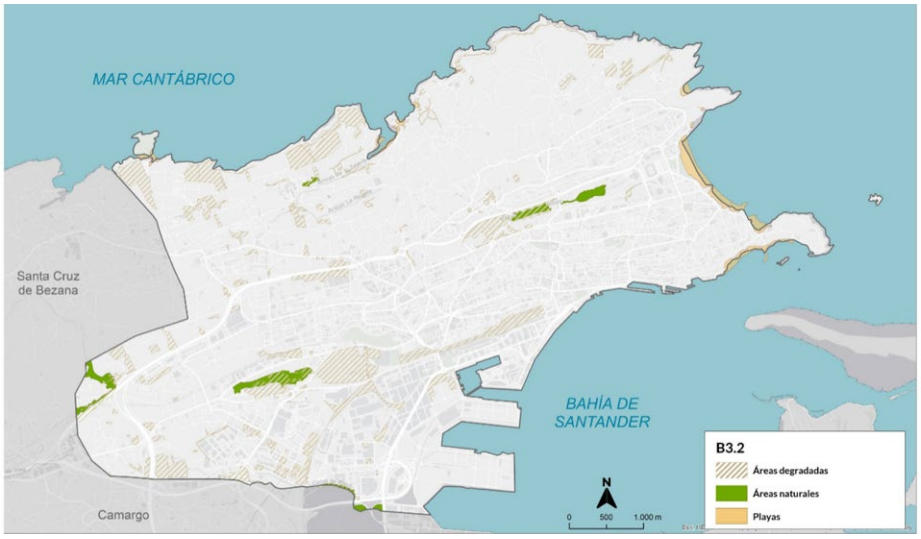
B3.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Coastal flooding, pluvial flooding, heat waves, drought	Municipal

MISSION OF THIS MEASURE

Define a strategy for the stewardship of natural areas with continuous monitoring of their state and evolutionary process.

FIGURE B3.2. Areas likely to be integrated into land stewardship strategies



Source: CINCc (UC) - FIC, 2024 based on data from Santander City Council

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,00

FOR MORE INFORMATION

Reference: Programa de Fomento de la Custodia del Territorio para la Conservación y el Desarrollo Sostenible de los Espacios Naturales Protegidos de Andalucía (Portal ambiental de Andalucía, 2021)

More information at: https://www.juntadeandalucia.es/medioambiente/portal/areas-tematicas/espacios-protegidos/dinamizacion-socioeconomica-espacios-protegidos/programa-fomento-custodia-territorio

MONITORING INDICATORS

Surface area of degraded areas / Surface area of natural areas

No. of natural areas with management and conservation plan (land stewardship)

RESILIENT CITY GOAL

Making cities resilient to climate change involves a multidimensional approach that adapts both the urban fabric and critical infrastructure to future challenges. This goal is achieved through the development and implementation of innovative urban planning tools capable of anticipating climate impacts and designing effective adaptation strategies.

To reduce the impact of extreme temperatures, the development of green infrastructure, such as parks and green roofs, which can provide shaded areas and help reduce the urban heat island effect, should be encouraged. These areas not only improve the quality of life and well-being of citizens, but also become tools for the thermal regulation of cities.

Extreme rainfall events require special attention with improved drainage systems and storm-water management techniques, such as rain gardens and permeable pavements, which allow for the efficient absorption and management of excess water, thus reducing the risk of urban flooding.

In the face of rising sea levels, it is necessary to strengthen coastal management and develop protection zones that can absorb coastal phenomena, protecting critical infrastructure and residential areas close to the coast. This should be complemented by reassessment and, if necessary, relocation of the most vulnerable infrastructures. Early warning protocols and rapid response systems are crucial to minimise damage and ensure public safety in the face of extreme weather events. Warning systems must be accessible and comprehensive, ensuring effective communication and rapid mobilisation of resources and emergency services.

Therefore, it is necessary to implement efficient rainwater harvesting and reuse systems, improve the efficiency of irrigation in urban green spaces, and develop policies that promote responsible water use among citizens. Together, these measures and strategies contribute to building more resilient cities, capable of facing and adapting to the challenges imposed by climate change, ensuring the sustainability, safety and quality of life of their inhabitants.

OBJECTIVES

R1 Developing tools to enable planning for a climate-resilient city

R2 Reducing the impact of extreme temperatures on the urban fabric

R3 Reducing the impact of extreme precipitation on the urban fabric

R4 Reducing the impact of sea level rise on the coastline

R5 Be prepared with protocols for early warning and response to extreme events

R6 Optimising and controlling water resources in a climate change scenario

Objective R.1: **Developing tools to enable planning for climate-resilient city**

Developing adaptation strategies with a multidisciplinary approach involves collaboration between experts in environment, urban planning, agriculture, public health and other relevant areas. This integrated approach ensures that solutions are holistic and address multiple aspects of the climate challenge.

Climate-smart urban planning is a tool for incorporating climate considerations into the design and management of urban spaces. A planning policy that integrates green infrastructure, sustainable public spaces and biodiversity conservation areas into the urban fabric is needed. In addition, urban development practices that minimise environmental impact and promote energy efficiency and rational land use should be adopted.

The Blue Infrastructure Plan focuses on sustainable water management, using natural systems such as wetlands, restored urban rivers and infiltration areas to improve the quality and availability of water resources in urban environments. Within this aspect, coastal spaces should be considered, which in the case of Santander have various strategic functions.

Adaptation Monitoring and Evaluation Protocols are essential to ensure that the measures implemented are effective over time. The protocols allow for monitoring progress, identifying areas for improvement and adjusting strategies as necessary to maintain urban resilience, including control of the energy system, housing conditions or the use and transformation of rural land.

R1.1 Development of adaptation strategies with a multidisciplinary approach

R1.2 Drafting of a climate-adapted urban planning

R1.3 Blue Infrastructure Plan

R1.4 Protocols for Monitoring and Evaluation

R1.5 Adapted electrical system

R1.6 Protected agricultural land

R1.7 Control of unhealthy areas in buildings

Development of adaptation strategies with a multidisciplinary approach

R1.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Heat waves, pluvial flooding, coastal flooding, drought, wind	Municipal

MISSION OF THIS MEASURE

Avoid maladaptation by planning effective measures with a multidisciplinary approach, including landscape, socio-economic, environmental, etc., criteria.

FIGURE R1.1. Multidisciplinary teams

Source: Getty Images (CC).

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 9,64

FOR MORE INFORMATION

Reference: Mejora de la adaptación intersectorial al cambio climático en el sudeste de Queensland, Australia.

More information at: https://link.springer.com/article/10.1007/s10113-013-0442-6#citeas

MONITORING INDICATORS

No. of sectors benefiting from the adaptation action

GHG reduction value of the adaptation action (mitigation benefits)

Drafting of a climate-adapted urban plan R1.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Heat waves, pluvial flooding, coastal flooding, drought, wind	Municipal

MISSION OF THIS MEASURE

Integrate adaptation criteria into urban planning: 1. Future climate scenarios; 2. Delimitation of Urban Adaptation Areas (AAU) and 3. General Systems of Open Spaces as a reserve for adaptation.

FIGURE R1.2. Resilient urban planning

Source: Getty Images (CC).

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 9,38

FOR MORE INFORMATION

Reference: Diseño de un escenario estratégico para la región central de Arizona-Phoenix
More information at: https://www.sciencedirect.com/science/article/pii/S0169204619309478.

MONITORING INDICATORS

Existence of future climate analysis in urban planning
No. of Urban Adaptation Areas identified
Surface area (m^2) of the General System of Open Spaces destined to climatic refuges

Blue infrastructure plan

R1.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Pluvial flooding, coastal flooding	Municipal

MISSION OF THIS MEASURE

Create a Blue Infrastructure Master Plan for Santander, with a strategy adapted to climate change.

FIGURE R1.3. Surroundings of El Bocal in Costa Quebrada, Santander

Source: CINCc (UC), 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,23

FOR MORE INFORMATION

Reference: Integración de la infraestructura azul-verde en la Planning urbana en las ciudades de Chennai y Kochi, India.

More information at: https://www.sciencedirect.com/science/article/pii/S0264837722004823

MONITORING INDICATORS

Identification of blue spaces

Area of naturalised water bodies created or restored

No. of blue spaces with ecological functions

Protocols for monitoring and evaluation

R1.4

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Heat waves, pluvial flooding, coastal flooding, drought, wind	Municipal

MISSION OF THIS MEASURE

Create a protocol for monitoring adaptation criteria in public and private works projects, justifying the progress achieved.

FIGURE R1.4. Urban Adaptation Support Tool

Source: Covenant of Mayors

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 9,64

FOR MORE INFORMATION

Reference: Propuesta de metodología para planes de adaptación climática a nivel local (Plataforma de riesgo y adaptación climática territorial (PRACT), 2022)

More information at: https://www.adaptacionclimatica.cl/assets/pdf/Metodologia-de-adaptacion.pdf

MONITORING INDICATORS

No. of monitoring protocols by areas or sectors of activity

No. of adaptation measures carried out or promoted by actions

Adapted electrical system R1.5

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Heat waves	Municipal

MISSION OF THIS MEASURE

Adapt the load capacity of the municipal electricity system to peak demand due to extreme temperatures.

FIGURE R1.5. Electricity grid

Source: Getty Images (CC).

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,00

FOR MORE INFORMATION

Reference: Adaptación del sector eléctrico de California al cambio climático. (Klotz, M., y Schäuble, B. 2011)

More information at: https://link.springer.com/article/10.1007/s10584-011-0242-2

MONITORING INDICATORS

No. of safety and resilience assessments of the municipal electricity system

Time to restore service in the event of grid outage or collapse

Percentage of diversification of supply sources / Degree of external dependence

Protected agricultural land

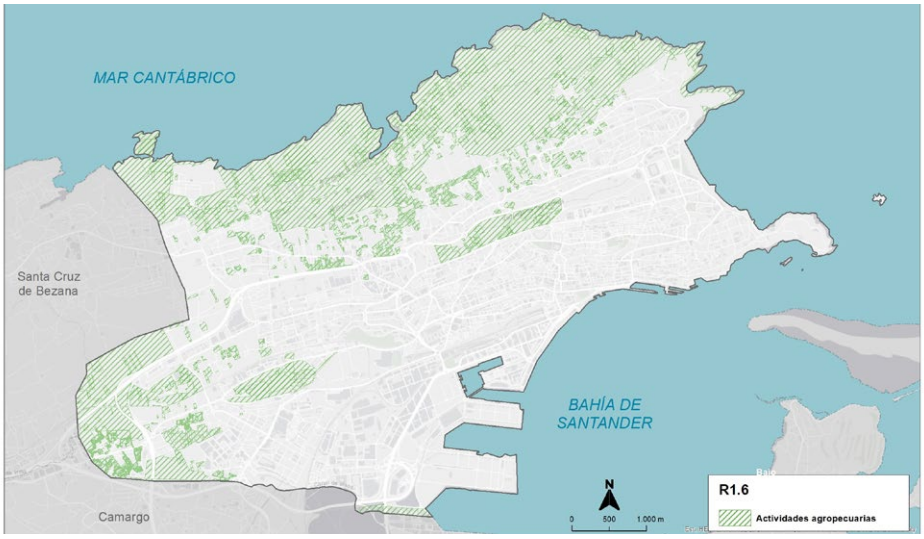
R1.6

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Heat waves, pluvial flooding, derivated vectors	Punctual

MISSION OF THIS MEASURE

Protect municipal agricultural land to promote greater food sovereignty.

FIGURE R1.6. Areas used for agricultural activities



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 6,62

FOR MORE INFORMATION

Reference: Agenda de la alimentación urbana (Organización de las Naciones Unidas para la Alimentación y la Agricultura (FAO), 2024)
More information at: https://www.fao.org/urban-agriculture/es/

MONITORING INDICATORS

Total annual agricultural area / Municipal area
Diversity and typology of organic crops / Total agricultural area
Soil organic matter level (Annual values)

Control of unhealthy areas in buildings R1.7

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Health – derivated vectors	Punctual

MISSION OF THIS MEASURE

Identify unhealthy spaces in old buildings that may have damp, and dingy underfloors.

FIGURE R1.7. Presence of dampness in buildings

Source: CINCc (UC), 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 6,15

FOR MORE INFORMATION

Reference: Control de espacios y viviendas en situaciones de insalubridad A(yuntamiento de Terrassa, 2024)

More information at: https://www.terrassa.cat/es/control-d-espais-i-habitatges-en-situacio-d-insalubritat

MONITORING INDICATORS

No. of dwellings in unhealthy conditions / Total no. of dwellings in the municipality

Objective R.2: **Reducing the impact of extreme temperatures on the urban fabric**

To reduce the impact of extreme temperatures on the urban fabric, it is essential to implement measures that promote heat mitigation and improve the thermal comfort of urban spaces. Planting trees in temperature-critical areas is an effective strategy, as trees provide shade and reduce air temperature, helping to create cooler and more pleasant microclimates.

Increasing green roofs and green façades is another key measure. Green roofs and green façades act as natural insulators, reducing heat absorption in buildings and helping to maintain cooler temperatures inside. These infrastructures improve air quality, absorb carbon dioxide and provide habitats for urban biodiversity.

The creation of climate-protected public spaces provides areas for rest and recreation during periods of extreme heat. Public spaces should be designed with shading elements, such as pergolas, canopies or plant structures, as well as with heat-reflecting materials, such as permeable paving and high-albedo surfaces.

Increasing high albedo surfaces, i.e., those that reflect solar radiation, helps to reduce heat absorption in the city and mitigate the urban heat island effect. The use of reflective materials in streets, squares and car parks, as well as the use of cool roofs, helps to achieve these objectives.

Revegetation of roads and footpaths provides multiple benefits, including reducing soil temperature, retaining moisture and improving the urban landscape. Also, the creation of climate-compatible pedestrian routes, connecting green and shaded areas, facilitates sustainable mobility and promotes outdoor physical activity.

Together, these measures not only help to reduce the impact of extreme temperatures on the urban fabric, but also contribute to creating cities that are more sustainable, healthier and more resilient to climate change. Six measures have been selected for Objective R.2:

R2.1 Tree planting in temperature-critical areas
R2.2 Increase in green roofs and green façades
R2.3 Climate-protected public spaces
R2.4 Increase of high albedo surfaces
R2.5 Revegetation of roads and paths
R2.6 Creation of climate-friendly pedestrian routes

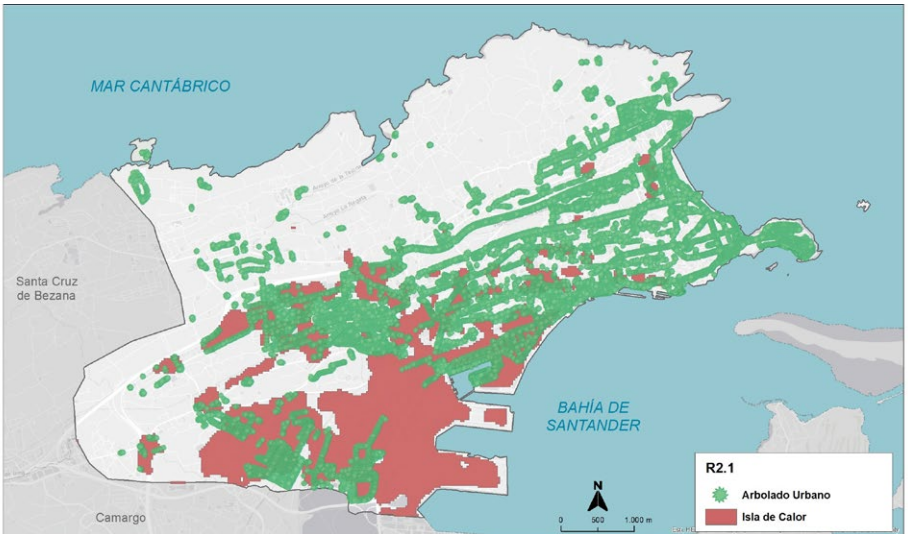
Tree planting in temperature critical areas R2.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Nature-based solutions	Heat waves, pluvial flooding	Municipal

MISSION OF THIS MEASURE

Increase the number of trees to obtain increased evapotranspiration and urban coolness in areas identified as potential heat islands.

FIGURE R2.1. Tree planting areas in high surface temperature zones



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,77

FOR MORE INFORMATION

Reference: El papel del paisaje arbóreo para reducir los efectos de las islas de calor urbanas en las ciudades brasileñas de Curitiba y Sao Paulo

More information at: https://link.springer.com/article/10.1007/s00468-021-02230-8

MONITORING INDICATORS

Surface area of new naturalised areas / Areas with potential for high temperatures

No. of trees and shrubs planted in identified high temperature areas

Increase in green roofs and green façades R2.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Constructive	Heat waves, pluvial flooding	Punctual

MISSION OF THIS MEASURE

Increase the area of green/cool roofs and green façades with a programme that identifies the most viable buildings and sets short-term targets.

FIGURE R2.2. Green roof located at the building of Physics Institute of Cantabria

Source: University of Cantabria

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,31

FOR MORE INFORMATION

Reference: El edificio residencial 'Agora Garden' (Taiwán) como jardín vertical

More information at: https://www.construible.es/2019/03/01/edificio-residencial-agora-garden-eleva-taiwan-jardin-vertical-forma-helicoidal

MONITORING INDICATORS

Area of green - cool roofs / Total area of roofs in heat island zones

Area of green façades

Climate-protected public spaces

R2.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Constructive	Heat waves, pluvial flooding	Neighbourhood

MISSION OF THIS MEASURE

Incorporate in the design of public spaces areas of protection from rain and sunlight to improve their thermal comfort.

FIGURE R2.3. Science Square

Source: CINCc (UC), 2024

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,08

FOR MORE INFORMATION

Reference: Proyecto de mejora del confort térmico en el casco antiguode Trebujena (Ayuntamiento de Trebujena, 2022)

More information at: Confort Térmico Trebujena. https://contrataciondelestado.es/wps/wcm/connect/b6194d6a-d3fc-497f-a1db-31c1cc959525/DOC20221109082350PROYECTO+DE+OBRAS+QUE+INCLUYE+PPTP+Y+ANEXO+SUBSANACION.pdf?MOD=AJPERES%20

MONITORING INDICATORS

No. of public spaces with weather protection features

No. of infrastructures and equipment for protection from rain and sunshine

Increase of high albedo surfaces

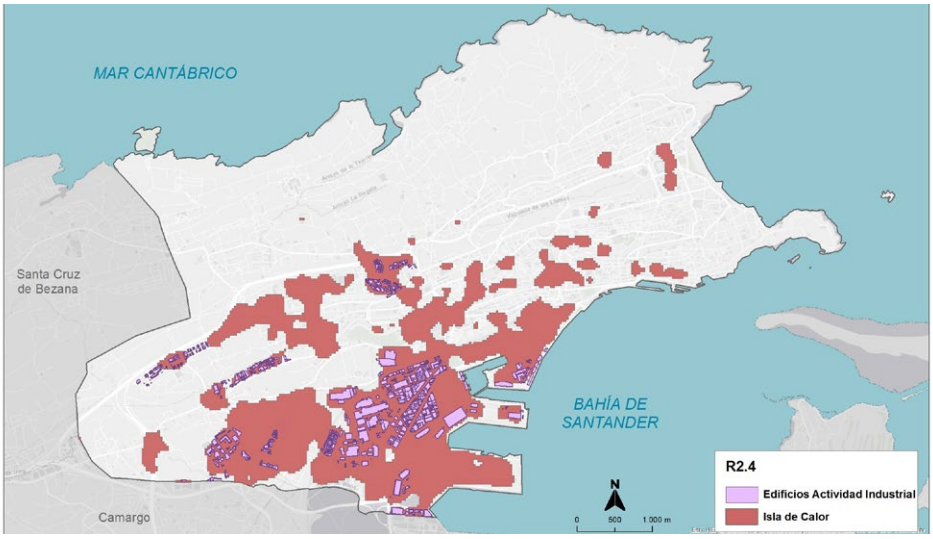
R2.4

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Constructive	Heat waves	Neighbourhood

MISSION OF THIS MEASURE

Increase high albedo surfaces on pavements and roofs in industrial areas, especially in sectors affected by urban heat islands.

FIGURE R2.4. Industrial areas in high surface temperature sectors



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,00

FOR MORE INFORMATION

Reference: Rendimiento térmico del pavimento y contribución al clima urbano y global (Federal Highway Administration, US Department of Transportation)
More information at: https://www.fhwa.dot.gov/pavement/enstewardship.cfm

MONITORING INDICATORS

Paved area with high albedo / Total paved area
Percentage of high albedo industrial roof surface in heat island areas

Revegetation of roads and paths

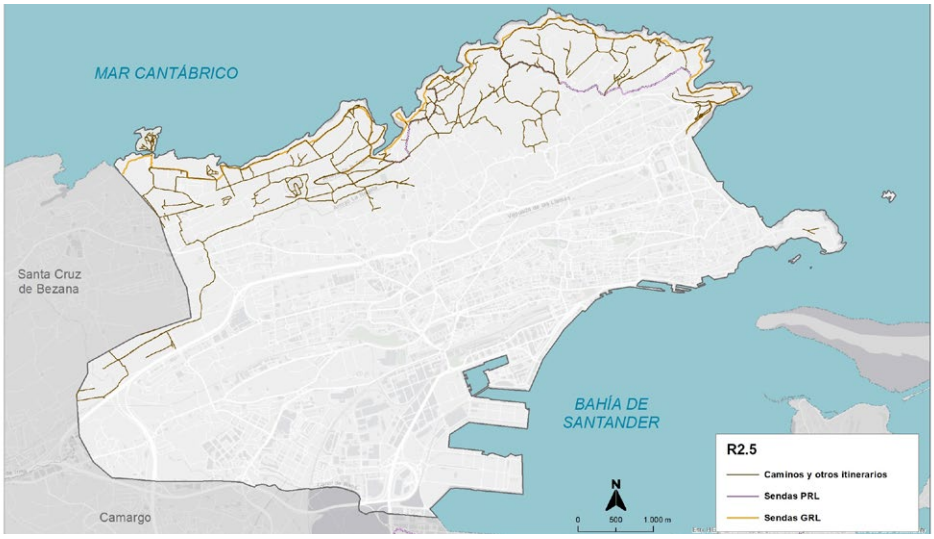
R2.5

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Heat waves, pluvial flooding, wind	Municipal

MISSION OF THIS MEASURE

Develop revegetation interventions using bushes and native trees on rural roads and paths to create shaded areas and wind protection.

FIGURE R2.5. Rural roads and footpaths with potential for tree planting



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,70

FOR MORE INFORMATION

Reference: Corredor verde Oliver-Valdefierro, Zaragoza
Más información: https://www.zaragoza.es/ciudad/urbanismo/arquitect/valdefierrooliver.htm

MONITORING INDICATORS

Length (m) of revegetated paths or trails
Percentage of the network of paths and trails with tree cover

Creation of climate-friendly pedestrian routes R2.6

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Constructive	Heat waves	Punctual

MISSION OF THIS MEASURE

Link vertical pedestrian routes (ramps and stairs) to shaded rest areas.

FIGURE R2.6. La Teja Park

Source: CINCc (UC), 2024

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 6,69

FOR MORE INFORMATION

Reference: Buenas Prácticas en Accesibilidad Universal (Junta de Comunidades de Castilla La Mancha, 2012)

More information at: https://www.castillalamancha.es/sites/default/files/documentos/20120511/librobuenaspracticasaccesibilidaduniversal.pdf

MONITORING INDICATORS

Surface area of open spaces with protected areas / Total surface area of open spaces

No. of trees per total length of roads and footpaths in public areas

Objective R.3: Reducing the impact of extreme precipitation events on the urban fabric

Measures that effectively manage excess water and reduce the risk of flooding can be taken to control extreme rainfall in the urban fabric. The implementation of Sustainable Urban Drainage Systems (SUDS) allows the use of natural techniques to manage rainwater, such as permeable green areas, retention ponds and green roofs, allowing water infiltration into the ground and reducing surface runoff.

The implementation of a separate sanitation network is another strategic measure. This network separates stormwater from wastewater, channelling it into sustainable drainage systems rather than mixing it with treated wastewater. Reducing the load on the drainage network and wastewater treatment plants minimises the risk of overflows during heavy rainfall events.

The creation of permeable public and private spaces is a common measure to increase the absorption capacity of the soil and reduce runoff. This is achieved through the use of permeable paving, rain gardens, landscaped areas and permeable green areas that allow rainwater to gradually infiltrate into the ground. The rain garden network consists in the creation of landscaped areas designed to capture and retain rainwater, allowing it to infiltrate into the ground, thereby reducing the risk of flooding. In this sense, capture in water ponds and reservoirs is also an efficient measure. Rain gardens can be located in public spaces as well as on private properties, such as residential gardens and commercial areas, but also along high-capacity roads and high slopes that generate a large volume of water in surface runoff. Adapting street furniture or developing strategies in urban planning are also necessary measures among those selected for Objective R.3.

The selected measures are as follows:

R3.1 SUDS implementation
R3.2 Implementation of a separate sanitation network
R3.3 Permeable public and private spaces
R3.4 Rain garden network
R3.5 Climate-adapted public transport stops
R3.6 Strategies for urban development
R3.7 Implementation of water recharge reserves

SUDS implementation

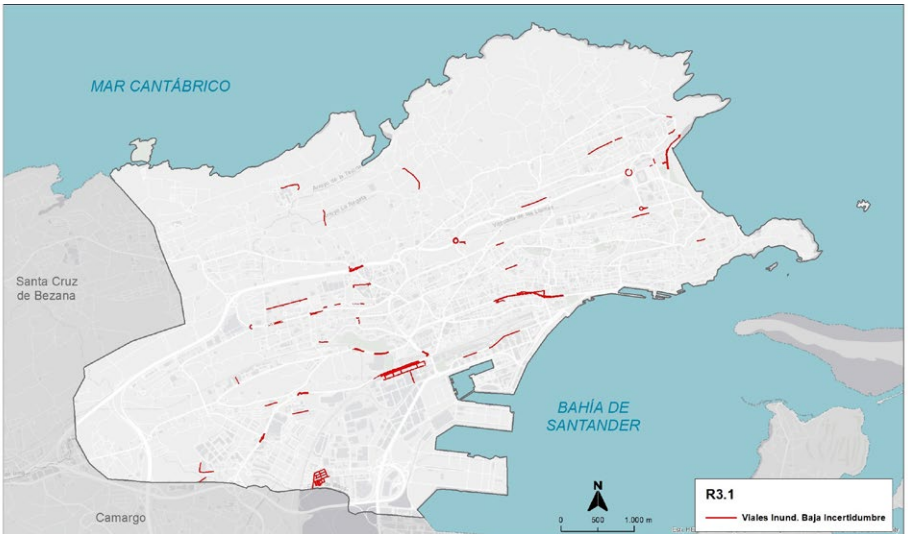
R3.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Constructive	Heat waves, pluvial flooding, drought	Punctual

MISSION OF THIS MEASURE

Implement a network of Sustainable Urban Drainage Systems (SUDS) that contribute to soil permeability, surface runoff management, and improved bathing water quality.

FIGURE R3.1. Low-uncertainty flooded roads



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,69

FOR MORE INFORMATION

Reference: The Circle, solución sostenible frente a inundaciones en Normal (Illinois) (Hoerr Schaudt, 2010)
More information at: https://www.hoerrschaudt.com/project/uptown-normal/?parent=90

MONITORING INDICATORS

No. of Sustainable Urban Drainage Systems implemented
Permeable area promoted by SUDS / Municipal permeable area

Implementation of a separate sanitation network R3.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Constructive	Pluvial flooding	Municipal

MISSION OF THIS MEASURE

Develop a separate sewerage network and storm tanks for extreme rainfall control.

FIGURE R3.2. Construction of the Sardinero storm water tank

Source: Ayuntamiento de Santander

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,54

FOR MORE INFORMATION

Reference: El camino del agua en el paisaje urbano, Neighbourhood de Bon Pastor, Barcelona
More information at:
https://aus.arquitectes.cat/wp-content/uploads/2014/05/2017_Soto_Perales_SuDSBonPastor_Bcn.pdf

MONITORING INDICATORS

Percentage of the sewerage network of a separate nature with respect to the total
Volume (hm^3) collected by storm tanks

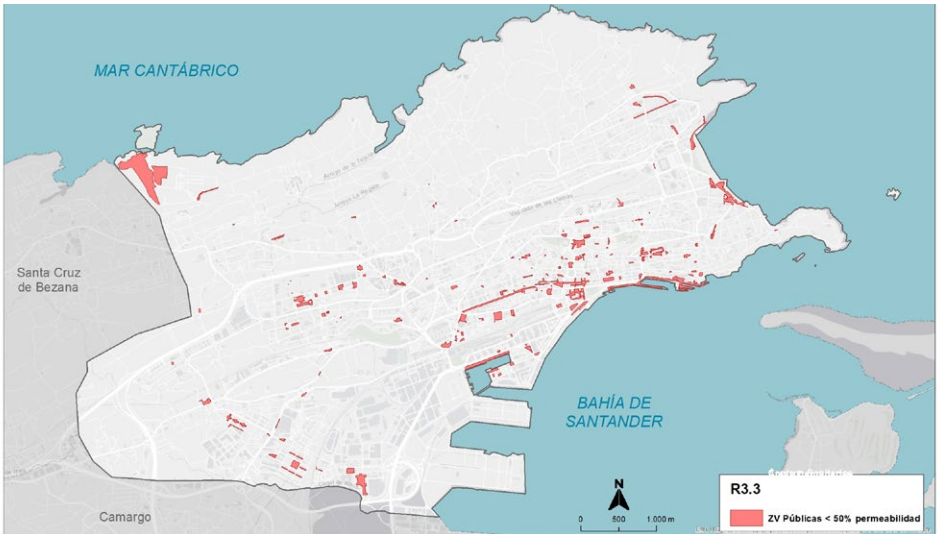
Permeable public and private spaces R3.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Heat waves, pluvial flooding, drought	Municipal

MISSION OF THIS MEASURE

Ensure that at least 50% of the surface area of identified public and private open spaces is permeable.

FIGURE R3.3. Public green areas with less than 50% permeable area



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,54

FOR MORE INFORMATION

Reference: Proyecto de ordenación urbana en el Neighbourhood de Vallcarca en Barcelona

More information at: https://ciclica.eu/es/projects/proyecto-de-ordenacion-urbana-en-el-barrio-de-vallcarca-en-barcelona/

MONITORING INDICATORS

Percentage of permeable open spaces / Total area of open spaces

Rain garden network

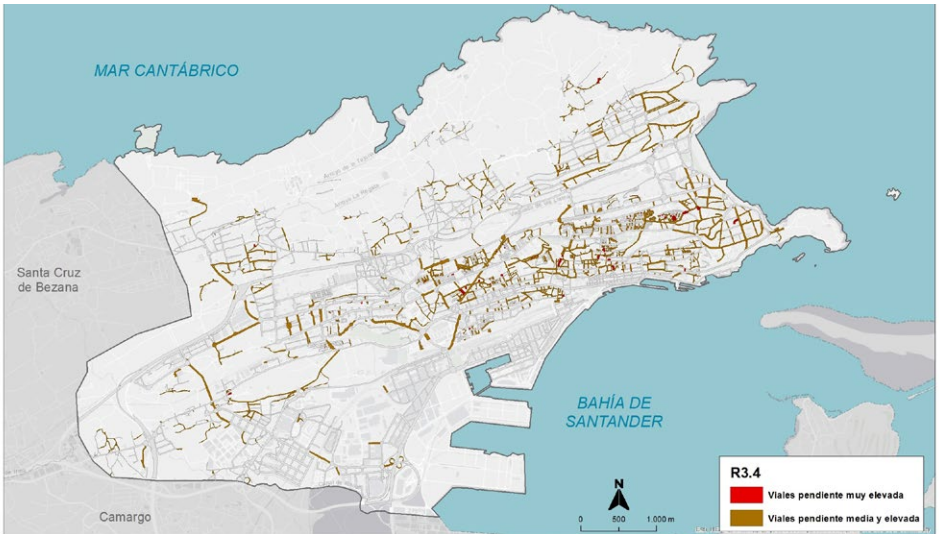
R3.4

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Nature-based solutions	Pluvial flooding	Punctual

MISSION OF THIS MEASURE

Create a network of Rain Gardens for surface runoff, especially along high-capacity roads and highly impermeable urban sections.

FIGURE R3.4. Roads with high and medium slopes for rain gardens



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,77

FOR MORE INFORMATION

Reference: Jardines de lluvia en Salamanca en el marco del proyecto LIFE Vía de la Plata
More information at: https://www.lifeviadelaplata.com/jardines-de-lluvia/

MONITORING INDICATORS

Installed area of rain gardens
Rain garden catchment area

Climate-adapted public transport stops

R3.5

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Constructive	Heat waves, pluvial flooding, wind	Punctual

MISSION OF THIS MEASURE

Adapt the design of bus shelters to wind and precipitation exposure to provide shelter during the winter.

FIGURE R3.5. Bus stop at Plaza de San Martín

Source: CINCc (UC), 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 6,54

FOR MORE INFORMATION

Reference: Refugios populares adaptados al clima: Evaluación sobre el terreno (University of Technology Sydney (UTS), 2018)

More information at: https://www.uts.edu.au/isf/explore-research/projects/climate-adapted-people-shelters#:~:text=The%20Climate%20Adapted%20People%20Shelters%20%28CAPS%29%20project%20has,heat%20and%20extreme%20weather%20events%20in%20Western%20Sydney

MONITORING INDICATORS

No. of bus stops protected from wind and precipitation

Strategies for urban development

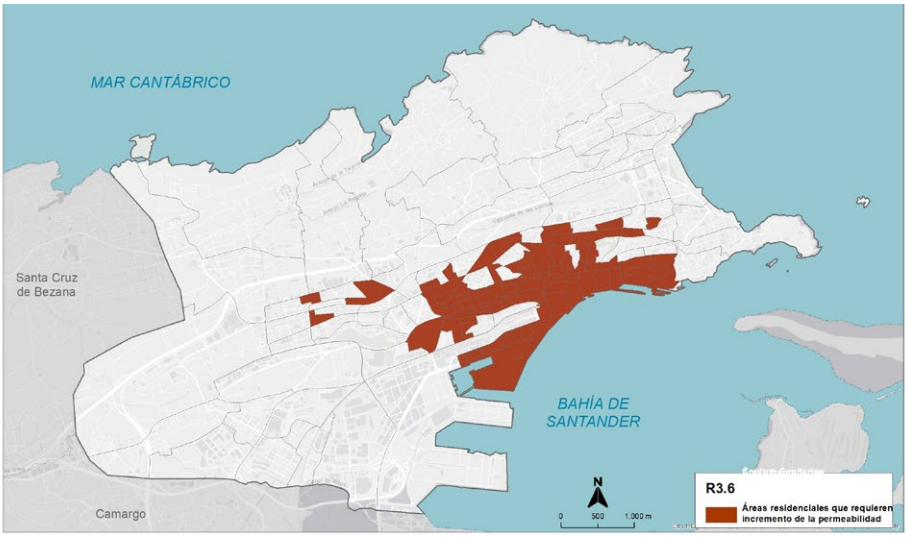
R3.6

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Pluvial flooding	Municipal

MISSION OF THIS MEASURE

Employ land-use transfer strategies to increase the presence of permeable zones in dense areas.

FIGURE R3.6. Census sections with low permeability



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 6,38

FOR MORE INFORMATION

Reference: Proyecto Madrid-Río (Besomi, A. 2011)

More information at: https://www.archdaily.co/co/02-89344/proyecto-madrid-rio-mrio-arquitectos-asociados-y-west-8

MONITORING INDICATORS

No. of land use transfer projects for retrofitting

Permeable area generated with land-use transfer projects

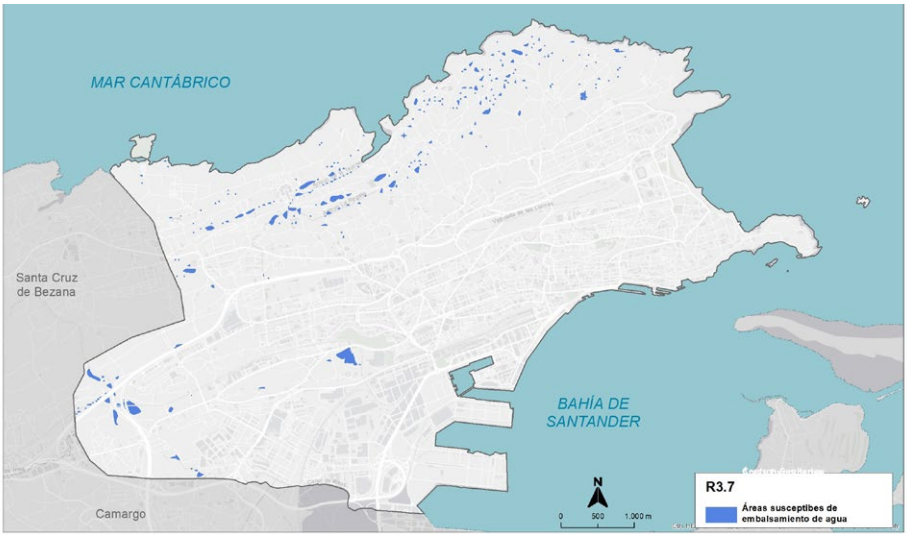
Implementation of water recharge reserves R3.7

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Constructive	Pluvial flooding	Municipal

MISSION OF THIS MEASURE

Create recharge water reservoirs by protecting sectors prone to flooding identified in the Blue Spots mapping

FIGURE R3.7. Areas susceptible to water impoundment



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 5,92

FOR MORE INFORMATION

Reference: Construcción de balsas para la recarga del acuífero del Baix Camp en el marco del proyecto LIFE REMAR

More information at: https://www.comaigua.cat/-/la-recarga-del-acuifero-del-baix-camp-proyecto-seleccionado-en-la-primera-fase-del-programa-life-2020-de-la-union-europea-

MONITORING INDICATORS

Identified surface area of water recharge reservoirs

Annual volume (hm^3) of abstraction from recharge ponds

Objective R.4: **Reducing the impact of sea level rise on the coastline**

In order to reduce the impact of sea level rise on the coast, measures must be implemented to protect coastal infrastructure and buildings, as well as to conserve natural ecosystems that act as barriers against erosion and flooding.

Firstly, it is proposed to adapt infrastructures and buildings to sea level rise through the design and development of coastal space. It is sometimes necessary to make the lower floors of existing buildings permeable, to build containment reinforcements, to redesign public space to adapt it to the impact of waves or to relocate critical infrastructures outside risk areas. Risk control measures should be implemented to effectively manage the hazards associated with sea level rise. Safety perimeters can be established in vulnerable coastal areas and surveillance systems can be developed to monitor the behaviour of the sea during coastal storms and extreme weather events.

Coastal sediment conservation is another important strategy to reduce the impact of sea level rise. Coastal sediments act as natural barriers that absorb wave energy and protect the coastline from erosion. Maintaining the integrity of these ecosystems by protecting coastal areas and restoring degraded habitats is essential to preserve their function as buffers against sea level rise.

Proper planning of the coastline will reduce impacts and, in extreme situations, restore the functionality of these sectors in less time. Santander's beaches are particularly prone to impacts from sea level rise. The redesign of the coastline of the Second Beach of El Sardinero may become necessary. Options such as the recession of the promenade and the redesign of the Mesones Park, raising its current height, could guarantee a response to the impact of storms. A very sensitive sector corresponds to the end of the promenade, next to the Hotel Chiqui. In this area, maritime protection structures should be proposed to reduce the energy of the waves by increasing the sheet of water, with solutions similar to the natural pools included in the LIFE COSTAdapta project. This type of solution is being tested on coasts with a rocky substrate such as the one in question.

Three basic measures have been defined for the development of Objective R.4:

R4.1 Infrastructures and buildings adapted to sea level rise
R4.2 Implementation of risk control measures
R4.3 Coastal sediment conservation

Infrastructures and buildings adapted to sea level rise

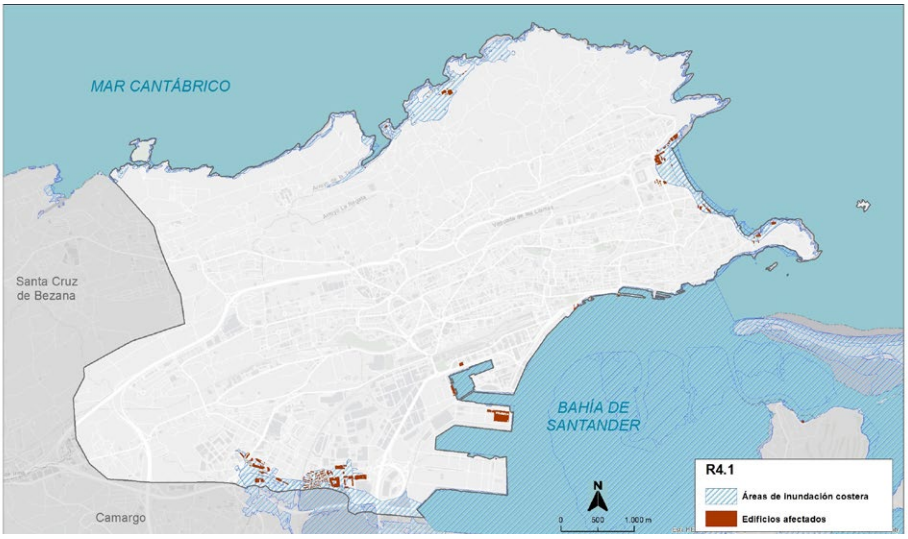
R4.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Constructive	Coastal flooding	Punctual

MISSION OF THIS MEASURE

Carry out defence and/or relocation works of infrastructures and buildings exposed to sea level rise, sea surges and strong waves in areas at risk.

FIGURE R4.1. Buildings exposed to sea level rise



Source: CINCc (UC) - FIC, 2024 based on data from PEMUSAN 2016

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,31

FOR MORE INFORMATION

Reference: Desarrollar la adaptación costera al cambio climático en la infraestructura de la ciudad de Nueva York: proceso, enfoque, herramientas y estrategias (García et al., 2018).
More information at: https://www.sciencedirect.com/science/article/abs/pii/S0264837717314278

MONITORING INDICATORS

No. of buildings exposed to coastal flooding
Building area exposed to sea level rise

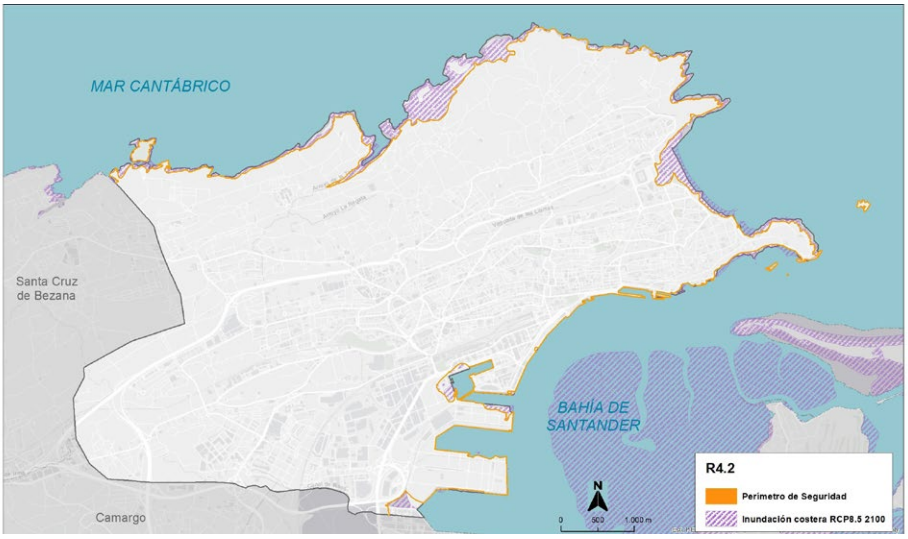
Implementation of risk control measures R4.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Coastal flooding	Municipal

MISSION OF THIS MEASURE

Establish security perimeters and surveillance measures during coastal storms in at-risk areas.riesgo

FIGURE R4.2. Coastal flooding safety perimeters



Source: CINCc (UC) - FIC, 2024 based on data from PEMUSAN 2016

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,00

FOR MORE INFORMATION

Reference: "Sistema de Alerta Temprana de Tsunamis del Pacífico" (PTWS) Estrategia (2022-2030). (Intergovernmental Oceanographic Commission (IOC) of UNESCO, 2012)
More information at: https://unesdoc.unesco.org/ark:/48223/pf0000384524

MONITORING INDICATORS

Area included within the security perimeter for extreme coastal events
Budget allocated to security and surveillance measures for extreme coastal events

Coastal sediment conservation R4.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Constructive	Coastal flooding	Punctual

MISSION OF THIS MEASURE

Design comprehensive measures for the conservation of sediments that favour the nourishment of beaches, without affecting their landscape value.

FIGURE R4.3. Sediment displacement on the Magdalena Peninsula, Santander

Source: CINCc (UC), 2024.

PRIORITY LEVEL	**HIGH**	**MEDIUM**	**LOW**	**Value: 6,85**

FOR MORE INFORMATION

Reference: Restauración de islas barreras para defensa de huracanes y del aumento del nivel del mar en Louisiana.

More information at: https://www.audubon.org/magazine/fall-2017/louisiana-restoring-its-barrier-islands-defend

MONITORING INDICATORS

Volume (m^3) of sediment with coastal protection capacity

Objective R.5: Be prepared with protocols for early warning and response to extreme events

Being prepared with early warning and response protocols for extreme events helps to protect communities and reduce the damage caused by natural disasters. One of the pillars of these protocols is the continuous monitoring of the response to extreme events, which involves closely monitoring the evolution of climatic phenomena such as storms, floods, droughts or other extreme events. This monitoring makes it possible to anticipate potential risks, assess the magnitude of the impact and take preventive measures in a timely manner.

For events such as drought, a well-defined action protocol is necessary. Water conservation measures can be implemented, promoting the efficient use of the resource and establishing restrictions when necessary. Strategies should also be developed to diversify water supply sources, such as investing in rainwater harvesting and storage infrastructure, and promoting treated water reuse practices.

Securing water supply is essential in preparing for extreme weather events. Mechanisms must be put in place to ensure the availability of drinking water even under conditions of scarcity, such as optimising water resource management, and implementing robust and resilient storage and distribution systems.

An additional strategy to prepare for extreme events is the implementation of insurance policies to cover weather-related losses. Insurance can provide financial compensation in case of material losses caused by extreme weather events, helping the municipality to recover more quickly from adverse impacts and reducing its economic vulnerability.

The aim, therefore, is to be prepared with early warning and response protocols for extreme events involving a combination of monitoring, planning, resource management and adaptation measures.

A total of four measures have been prioritised for Objective R.5:

R5.1 Monitoring the response to extreme events
R5.2 Drought action protocol
R5.3 Guaranteed water supply
R5.4 Implementation of insurance policies to cover weather-related losses

Monitoring the response to extreme events R5.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Create a tool to monitor the response of urban infrastructure and facilities to extreme events.

FIGURE R5.1. Monitoring tools

Source: Adaptecca (2024)

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,23

FOR MORE INFORMATION

Reference: 2023: Un año récord de eventos climáticos extremos y emisiones de CO_2. (Greenpeace, 2023).
More information at: https://es.greenpeace.org/es/noticias/eventos-climaticos-extremos-en-2023-entre-la-esperanza-y-la-ecoansiedad/

MONITORING INDICATORS

No. of monitoring tools
No. of people assigned to monitoring extreme events

Drought action protocol

R5.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Heat waves, drought	Municipal

MISSION OF THIS MEASURE

Develop an action protocol for drought events, with actions depending on the degree of intensity (number of days without rainfall and high temperatures) and assessment of irrigation demand.

FIGURE R5.2. Prolonged drought events

Source: Getty Images (CC)

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,00

FOR MORE INFORMATION

Reference: Protocolo de actuación por situación de drought. (Ajuntament de Barcelona, 2023)

More information at: https://ajuntament.barcelona.cat/ecologiaurbana/es/que-hacemos-y-porque/energia-y-cambio-climatico/plan-sequia

MONITORING INDICATORS

No. of protocols for monitoring against drought / Sector of activity

Guaranteed water supply

R5.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Constructive	Heat waves, drought	Municipal

MISSION OF THIS MEASURE

Guarantee water supply with a supplementary system in the event of a water cut.

FIGURE R5.3. Pronillo's coat of arms

Source: CINCc (UC), 2024

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,00

FOR MORE INFORMATION

Reference: Management sostenible del agua para la población y el medio ambiente de Nueva York.
More information at: https://www.nyc.gov/assets/dep/downloads/pdf/climate-resiliency/one-nyc-one-water.pdf

MONITORING INDICATORS

Volume (hm^3) of water stored in supplemental systems
No. of safety and resilience assessments of the municipal electricity system
Time to restore service in case of grid failure or collapse

Implementation of insurance policies to cover weather-related losses

R5.4

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Confirm the coverage of municipal insurance policies for risks associated with climate change.

FIGURE R5.4. Insurance policy management

Source: Getty Images (CC).

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 6,15

FOR MORE INFORMATION

Reference: Cobertura de riesgos extraordinarios derivables del cambio climático. (AdapteCCa, 2024). More information at: https://adaptecca.es/casos-practicos/cobertura-de-riesgos-extraordinarios-derivables-del-cambio-climatico

MONITORING INDICATORS

Economic value of policy coverage for climate change-related risks
Economic amount supported by policies for climate change impacts

Objective R.6: Optimising and controlling water resources in a climate change scenario

In a climate change scenario, optimising and controlling water resources is essential to ensure the availability of drinking water and to reduce the effects of climate variability. To achieve this, it is necessary to implement measures at the municipal level, as well as in the private sector. Firstly, it is essential to introduce water saving and leakage control elements in the municipal water supply network. It is essential to modernise infrastructure and install technologies that reduce water losses during transport and distribution. In addition, it is important to implement leakage control systems in open spaces, municipal facilities and equipment to avoid waste.

To promote water saving among citizens, communication and awareness-raising campaigns should be carried out. These campaigns can include practical advice on the efficient use of water in the home, the promotion of low consumption technologies and the importance of reducing water waste in everyday activities. In the private sector, regulations need to be developed to promote water efficiency in new construction, including requirements for rainwater harvesting and storage in buildings, as well as the use of water reuse technologies for non-potable uses such as garden irrigation and cleaning of outdoor spaces.

To increase the volume of rainwater storage, priority should be given to the construction of a network of closed tanks connected to the separate rainwater network. These reservoirs can be used to store rainwater and then used for municipal irrigation.

The recharge zones of the Aquifer Subsystem 4A San Román Unit and 4D Santander Unit should be protected to prevent saline intrusion due to sea level rise. The expansion of permeable zones that allow rainwater to infiltrate into the subsoil, thus recharging the underground aquifers and maintaining their adequate quality and quantity, would guarantee the success of this measure.

The optimisation and control of water resources requires the implementation of comprehensive measures at municipal and private level, ranging from the modernisation of infrastructures to the promotion of efficient water use and the protection of natural resources.

Objective R.6 will be achieved through the following four priority measures:

R6.1 Efficient supply network
R6.2 Promotion of water saving
R6.3 Rainwater storage
R6.4 Protection of aquifers

Efficient supply network

R6.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Technification	Drought	Municipal

MISSION OF THIS MEASURE

Introduce saving and leakage control elements in the supply network and in municipal open spaces, facilities and equipment.

FIGURE R6.1. Registration of water distribution network, Santander

Source: CINCc (UC), 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,31

FOR MORE INFORMATION

Reference: Orientaciones y gobernanza en la Management del agua y cambio climático (Gobierno de España)
More information at: https://www.miteco.gob.es/es/agua/temas/sistema-espaniol-gestion-agua.html

MONITORING INDICATORS

No. of leaks identified and repaired
Annual volume (hm^3) of water lost in leaks / Total volume of supply water
Average consumption of water resources (l/inhab/day)

Promotion of water saving

R6.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Education	Drought	Municipal

MISSION OF THIS MEASURE

Promote water saving with communication campaigns to the public

FIGURE R6.2. Water resource losses

Source: Getty Images (CC).

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,00

FOR MORE INFORMATION

Reference: Análisis crítico de las campañas de comunicación para fomentar la "cultura del agua" en México (HernándezÁvila, M. and Masso-Delgado, Y., 2016)

More information at: https://www.scielo.org.mx/scielo.php?pid=S0188-252X2016000200223&script=sci_arttext

MONITORING INDICATORS

Water consumption per inhabitant and floating population

No. of public awareness events and outreach materials

Rainwater storage

R6.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Constructive	Heat waves, pluvial flooding, drought	Municipal

MISSION OF THIS MEASURE

Increase the volume of rainwater storage with a network of closed tanks connected to the separate network. Encourage its use for municipal irrigation. In the private sector, develop water use regulations, requiring new buildings to collect and store rainwater.

FIGURE R6.3. Pronillo water deposit

Source: Aguas Municipales de Santander (2020)

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,85

FOR MORE INFORMATION

Reference: Depósito regulador de pluviales Joan Miró de Barcelona

Mas información en: https://www.iagua.es/blogs/jordi-oliveras/deposito-regulador-pluviales-joan-miro-barcelona

MONITORING INDICATORS

Stormwater storage capacity (Volume m^3) public and private

Volume (hm^3) of rainwater directly used for municipal irrigation

Protection of aquifers

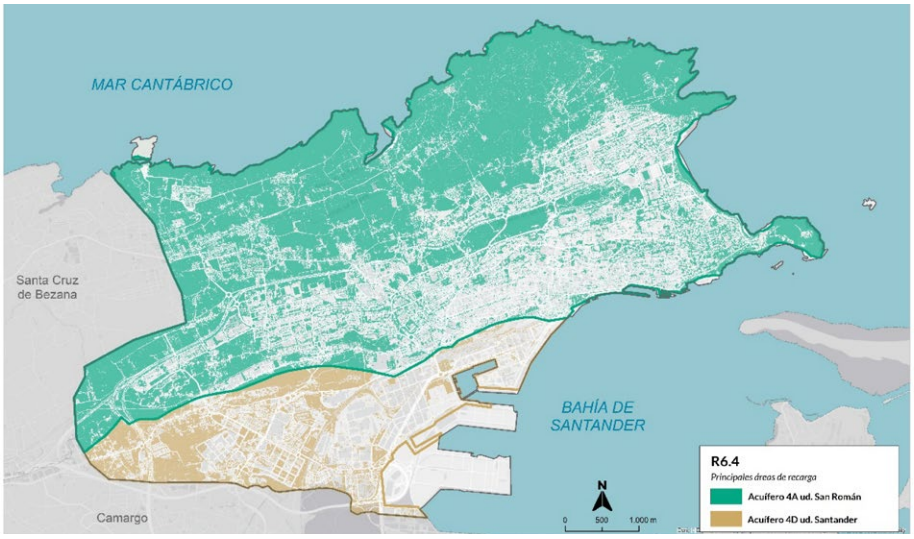
R6.4

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Pluvial flooding, coastal flooding	Punctual

MISSION OF THIS MEASURE

Protect the recharge zones of the aquifer Subsystem 4A San Román Unit and 4D Santander Unit in order to prevent saline intrusion due to sea level rise with the extension of permeable zones.

FIGURE R6.4. Aquifer recharge areas



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,23

FOR MORE INFORMATION

Reference: Medidas urbanísticas de adaptación al cambio climático en Santa Cruz de Galápagos, Ecuador (Pérez Celaya, N., 2020)

More information at: https://repositorio.unican.es/xmlui/handle/10902/21363

MONITORING INDICATORS

Permeable surface of aquifer recharge areas / Surface area of the recharge area

HEALTH GOAL

The Health Goal focuses on improving the resilience of health care services and the epidemiological surveillance system to protect the health of the population in a context of climate change. To achieve this, it is necessary to develop mechanisms to control and monitor climate change and its impact on public health, including the establishment of monitoring systems to identify and predict risks associated with extreme weather events and climate-related diseases.

It is important to have the capacity to respond to extreme weather and its effects on health, including the implementation of mitigation and adaptation measures, as well as the training of medical and emergency personnel to deal with climate-related crises such as heat waves, floods or vector-borne diseases.

An important part of this goal is to reduce the risk to the population most sensitive to extreme temperatures, such as the elderly, young children and people with chronic diseases. The implementation of awareness and prevention programmes favours the identification and protection of vulnerable groups, and the provision of adequate health services during adverse weather events for these sectors of the population. It also seeks to mitigate negative environmental conditions affecting public health, which would address problems such as air pollution, water quality, ecosystem degradation and exposure to toxic substances, which may be aggravated by climate change. Policies and actions should be implemented to reduce these environmental threats and promote healthier and safer environments for the population.

The Health Goal seeks to strengthen the health system's capacity to respond and adapt to climate change by implementing climate monitoring and control measures, preparing for extreme weather events, protecting vulnerable groups and promoting healthy environments. These actions are essential to address public health challenges in an ever-changing climate environment.

OBJECTIVES

SL1 Developing mechanisms for monitoring and tracking climate change impacts on health

SL2 Capacity to respond to extreme weather, minimising its effects on health

SL3 Reduce the risk of the most sensitive population to extreme temperatures

SL4 Reduce the negative environmental factors affecting health

Objective SL.1: Developing mechanisms for monitoring and tracking climate change impacts on health

Developing mechanisms to monitor and track climate change and its impact on health helps to protect the population from emerging environmental challenges. A key strategy is to establish a Biometeorological and Human Health Research Laboratory. This laboratory will study the relationships between atmospheric processes and human health, enabling a deeper understanding of how climate affects human well-being.

It is proposed that a complementary network of air quality and bioaerosol monitoring observatories, equipped with aeroallergen capture stations, would monitor pollutant and nanoparticle emissions at district or census section level, providing detailed air quality data.

Optimisation of the Smart City sensor network is another key measure. This network would allow real-time detection of high temperature hotspots in the city, which would facilitate the implementation of preventive actions to protect the population from the effects of extreme heat, such as heat stroke or dehydration. Sensors that are correctly located and provide reliable data for decision-making should be selected.

To strengthen epidemiological surveillance, systematic surveillance of vectors posing a potential risk to public health is proposed by monitoring the presence and activity of mosquitoes, ticks and other disease-transmitting vectors, which would allow early detection of possible outbreaks and the implementation of appropriate control measures. In addition, it is suggested that a mapping of possible vector nesting sites, such as open water impoundment, be created.

Finally, it is proposed that the impacts of the south wind be assessed on the physical and mental health of the population, which would allow a better understanding of how this climatic phenomenon affects people's well-being in order to develop appropriate adaptation and mitigation strategies. Taken together, these measures would contribute to improving the response capacity of Santander to the public health challenges associated with climate change.

For Objective SL.1 the following six measures have been established:

SL.1.1 Biometeorological and human health research laboratory
SL.1.2 Air quality observatory network
SL.1.3 Climate sensors network
SL.1.4 Surveillance and early warning for health risk vectors
SL.1.5 Mapping hotspots of diseases vectors associated with high temperatures
SL.1.6 Southern wind impact monitoring

Biometeorological and human health research laboratory

SL1.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Technification	Health	Municipal

MISSION OF THIS MEASURE

Develop a Biometeorological and Human Health Research Laboratory to study the relationships between atmospheric processes and human health and well-being.

FIGURE SL1.1. Bio-meteorological monitoring laboratories

Source: Pixabay Creative Commons Zero (CC0).

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,69

FOR MORE INFORMATION

Reference: El cambio climático y la Salud en Cuba. (Borroto et al, 2022)

More information at: https://www.paho.org/sites/default/files/2023-05/cambio-climatico-salud-cuba.pdf

MONITORING INDICATORS

No. of persons employed at the Biometeorological-Human Health Research Laboratory

No. of research and studies published by the laboratory

Air quality observatory network

SL1.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Technification	Health	City

MISSION OF THIS MEASURE

Create a complementary network of air quality observatories, bio-aerosol monitoring (with aero-allergen capture stations) to monitor pollutant and nanoparticle emissions at census section scale.

FIGURE SL1.2. Measuring stations

Source: CINCc (UC), 2024, based on CIMA, Gobierno de Cantabria

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,62

FOR MORE INFORMATION

Reference: Red de control y vigilancia de la calidad del aire en Cantabria (Centro de Investigación de Medio Ambiente (CIMA), 2015).

More information at: https://cima.cantabria.es/calidad-del-aire

MONITORING INDICATORS

No. of data collection stations

Daily count of particulate matter concentration below 2.5 microns

Climate sensors network

SL1.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Technification	Health	Municipal

MISSION OF THIS MEASURE

Optimise the Smart City sensor network to detect high temperature hotspots in real time.

FIGURE SL1.3. Smart City Santander Equipment

Source: CINCc (UC), 2024

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,46

FOR MORE INFORMATION

Reference: Red de sensores SmartCity para la vigilancia de la salud en Barcelona
More information at: https://www.barcelona.cat/infobarcelona/ca/tema/smart-city

MONITORING INDICATORS

Number of optimised Smart City sensors
Sensor coverage area

Surveillance and early warning for health risk vectors

SL1.4

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Heat waves, health	Municipal

MISSION OF THIS MEASURE

Strengthen epidemiological surveillance with systematic surveillance of vectors posing a potential risk to the population for possible incorporation into an early warning system.

FIGURE SL1.4. Vector-transmitting mosquito

Source: Pixabay, Creative Commons, Zero (CC0).

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,46

FOR MORE INFORMATION

Reference: Mosquito Alert, pieza clave de un proyecto reconocido por la Comisión Europea para alertar sobre enfermedades transmitidas por mosquitos (Premio EIC Horizon de Alerta Temprana para epidemias)
More information at Mosquito Alert: https://map.mosquitoalert.com/es

MONITORING INDICATORS

No. of vectors identified
No. of annual vector surveillance campaigns

Mapping hotspots of diseases vectors associated with high temperatures

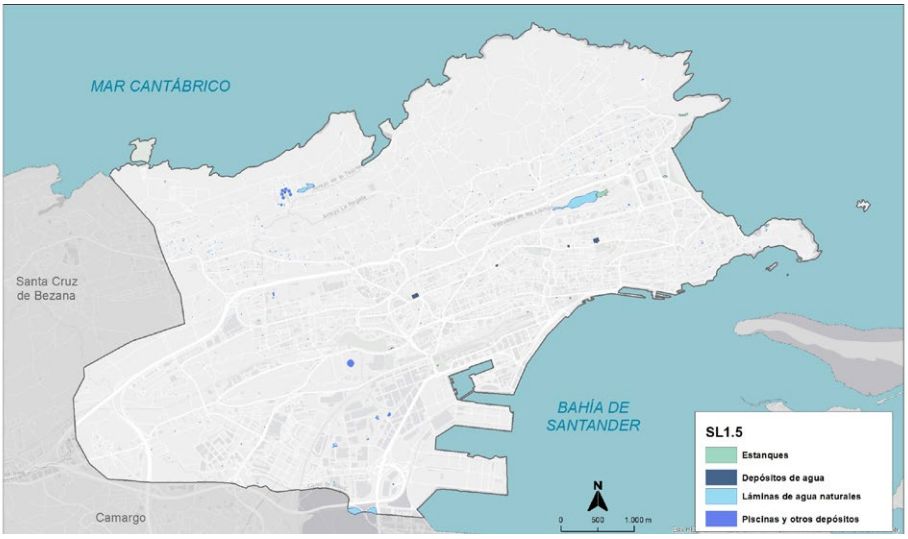
SL1.5

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Heat waves, health	Municipal

MISSION OF THIS MEASURE

Create a mapping of potential breeding sites for disease vectors associated with high temperatures, especially outdoor water impoundment.

FIGURE SL1.5. Possible sources of disease vectors



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 6,85

FOR MORE INFORMATION

Reference: El observatorio mundial de la salud. (Organización Mundial de la Salud (OMS), 2024)
More information at: https://www.who.int/data/gho/map-gallery

MONITORING INDICATORS

Surface area of areas identified as sources of disease vectors

Southern wind impact monitoring

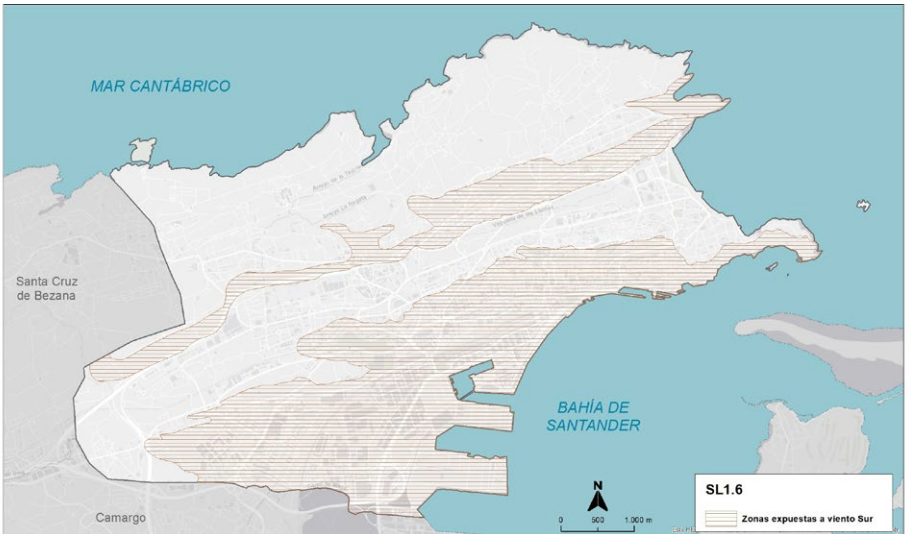
SL1.6

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Education	Heat waves, wind, health	Municipal

MISSION OF THIS MEASURE

Assess the impacts of South wind (by measuring its electrical characteristics) on the physical and mental health of citizens.

FIGURE SL1.6. South wind exposure



Source: CINCc (UC) - FIC, 2024 based on data from PEMUSAN 2016

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 6,31

FOR MORE INFORMATION

Reference: Evaluación del wind y directrices para ciudades inteligentes. (Actiflow, 2020)
More information at: https://actiflow.com/wind-assessment-and-guidelines-for-smart-cities/#

MONITORING INDICATORS

No. of inhabitants in areas at risk due to wind south
No. of people affected in hospitals depending on the frequency and duration of the events

Objective SL.2: Capacity to respond to extreme weather, minimising its effects on health

To develop mechanisms for monitoring and tracking climate change and its impact on health, a public health early warning system should be established. This system would provide early warning of extreme weather events, such as heat waves, unfavourable air quality conditions or south wind, allowing effective coordination between primary health care services, social and health organisations and civil protection.

A necessary measure is to establish a specific action protocol for heat wave events. This protocol would include a hierarchy of actions depending on the degree of intensity of the heat wave, from surveillance and monitoring of vulnerable people to coordination between health and care agencies to provide medical care and assistance to those in need. The expected increase in this phenomenon makes it necessary to systematise prevention and control programmes, targeting vulnerable groups, especially the elderly.

Another important aspect is to define action protocols for the control of pests and disease vectors associated with heat waves and high temperatures, implementing control and prevention measures, such as the fumigation of areas prone to the proliferation of mosquitoes and ticks, as well as the elimination of insect and rodent breeding sites.

Water storage in fountains and ponds also needs to be properly managed to prevent the proliferation of disease vectors. Plausible measures include the implementation of water filtration and treatment systems, as well as regular maintenance of fountains and ponds to prevent the accumulation of stagnant water, which is an ideal breeding ground for mosquitoes and other disease vectors.

Extreme temperature events, although not specific to the city of Santander, may appear as occasional episodes in which long periods of high temperatures are reached, and should, therefore, be taken into account in the mechanisms for the control and management of social and health emergencies.

Four main adaptation measures have been established for Objective SL2:

SL.2.1 Early warning system for extreme events
SL.2.2 Protocols for heat wave events
SL.2.3 Protocols for heat-related pest control actions
SL.2.4 Management of water storage for vector control

Early warning system for extreme events

SL2.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, wind, drought	Municipal

MISSION OF THIS MEASURE

Establish a public health early warning system for extreme heat events, unfavourable air quality conditions or south wind and facilitate the coordination of primary care services, socio-health entities and civil protection.

FIGURE SL2.1. Mobile early warning systems

Source: Getty Images (CC)

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,62

FOR MORE INFORMATION

Reference: La OMS prepara un sistema de alerta temprana para personas en riesgo de Heat waves (Agencia SINC, 2023)

More information at: https://www.agenciasinc.es/Noticias/La-OMS-prepara-un-sistema-de-alerta-temprana-para-personas-en-riesgo-por-olas-de-calor

MONITORING INDICATORS

No. of people with secured access to the Early Warning System

Protocols for heat wave events

SL2.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Heat waves	Municipal

MISSION OF THIS MEASURE

Establish an action protocol for heatwave events through a hierarchy of actions depending on the degree of intensity (monitoring of vulnerable people and coordination between health and care agencies).

FIGURE SL2.2. Sardinero-Santander Health Centre

Source: CINCc (UC), 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,62

FOR MORE INFORMATION

Reference: El Ayuntamiento de Madrid elabora un protocolo de actuación ante olas de calor en la ciudad (Diario de Madrid, 2023)

More information at: https://diario.madrid.es/blog/notas-de-prensa/el-ayuntamiento-de-madrid-elabora-un-protocolo-de-actuacion-ante-olas-de-calor-en-la-ciudad/

MONITORING INDICATORS

No. of official protocols approved for the Management of extreme heat events

No. of health service staff involved in the management of heat waves

Protocols for heat-related pest control actions SL2.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, drought	Municipal

MISSION OF THIS MEASURE

Define action protocols for the control of pests and disease vectors resulting from heat waves and high temperatures.

FIGURE SL2.3. Pest treatment and control

Source: Getty Images (CC)

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,23

FOR MORE INFORMATION

Reference: Impactos del cambio climático en la incidencia de plagas y enfermedades de los cultivos (CropLife LA, 2023)

More information at: https://www.croplifela.org/es/actualidad/impactos-del-cambio-climatico-en-la-incidencia-de-plagas-y-enfermedades-de-los-cultivos

MONITORING INDICATORS

No. of protocols established for different typologies of heat pests

Management of water storage for vector control SL2.4

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, drought	Neighbourhood

MISSION OF THIS MEASURE

Manage water storage in fountains and ponds for disease vector control.

FIGURE SL2.4. Vector sources

Source: Nueva España, 2020

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,85

FOR MORE INFORMATION

Reference: Estrategia de Gestión Integrada de Prevención y Control de Dengue para Uruguay. (Pan American Health Organization 2023).
More information at: https://www.paho.org/sites/default/files/2024-12/egi-dengue-uruguay.pdf

MONITORING INDICATORS

Volume (m^3) of water in treated open air sources and storage sites

Objective SL.3: Reduce the risk of the most sensitive population to extreme temperatures

In order to reduce the risk to the population most sensitive to extreme temperatures, measures should be proposed to mitigate the impact of intense heat and ensure a healthier and safer environment in urban settings. A key strategy is to increase urban coolness by creating fountain gardens in areas identified as heat islands. Green spaces not only provide a cooler and more pleasant environment, but also help to reduce the ambient temperature through water evaporation. However, it is important to ensure that these fountains have shut-off or emptying systems to prevent water stagnation and the proliferation of disease vectors such as mosquitoes.

In addition, establishing a network of park-and-ride facilities and limiting vehicle access to areas identified as urban heat islands during periods of intense heat can significantly contribute to reducing ambient temperatures and improving air quality.

Preventive care controls for older people in their own homes should be designed into action plans related to the impact of heat and epidemic situations, including the installation of air conditioning systems, regular visits by medical or care staff, and the promotion of self-care measures. Developing preventive outreach programmes targeting vulnerable people is another useful measure to avoid risky situations during heat waves. These programmes can include information on the importance of staying hydrated, avoiding direct exposure to the sun during the hottest hours, and engaging in moderate physical activity. Finally, it is necessary to encourage the development of studies on vulnerable groups that define the risk associated with the absence of thermal comfort, taking into account their health profiles, comorbidities and socio-economic situations, as well as their workplace.

A total of six measures have been designed for Objective SL.3:

SL.3.1 Creation of green areas and fountains in urban heat islands
SL.3.2 Reduction of road traffic in urban heat islands
SL.3.3 Preventive control of heat island impact on elderly people
SL.3.4 Information programmes on heat wave prevention
SL.3.5 Occupational heat risk mapping
SL.3.6 Studies on heat vulnerable groups

Creation of green areas and fountains in urban heat islands

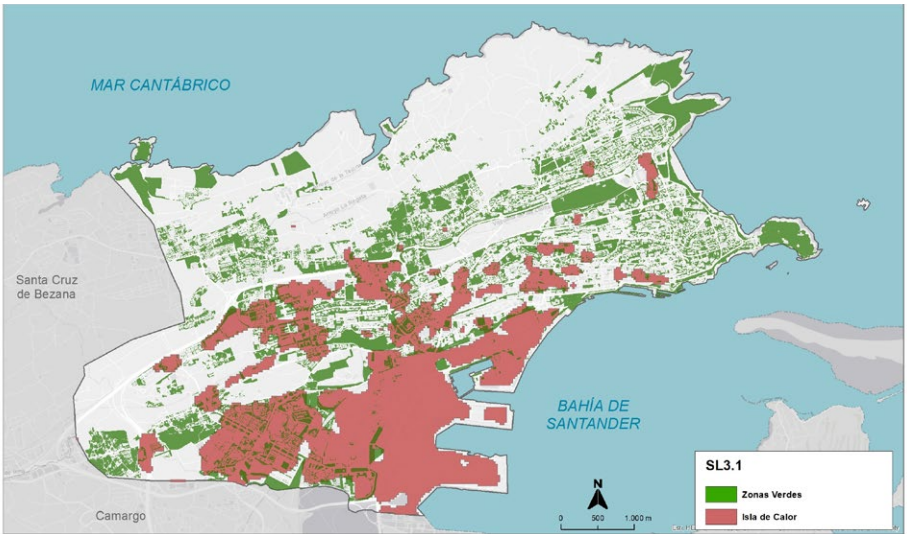
SL3.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Constructive	Heat waves, drought	Neighbourhood

MISSION OF THIS MEASURE

Increase urban coolness with fountain gardens in areas identified as heat islands. These fountains should have closing or emptying systems to avoid water stagnation and the proliferation of disease vectors.

FIGURE SL3.1. Areas of environmental improvement in urban heat island sectors



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,46

FOR MORE INFORMATION

Reference: Reducir los efectos de las islas de calor urbanas es el objetivo de los ganadores de Climathon 2023. (ORM, 2024)

More information at: https://www.orm.es/noticias-2024/reducir-los-efectos-de-las-islas-de-calor-urbanas-es-el-objetivo-de-los-ganadoras-de-climathon-2023/

MONITORING INDICATORS

Hourly temperature and humidity data collection in urban heat island areas

Naturalised area with green and blue infrastructure in urban heat island areas

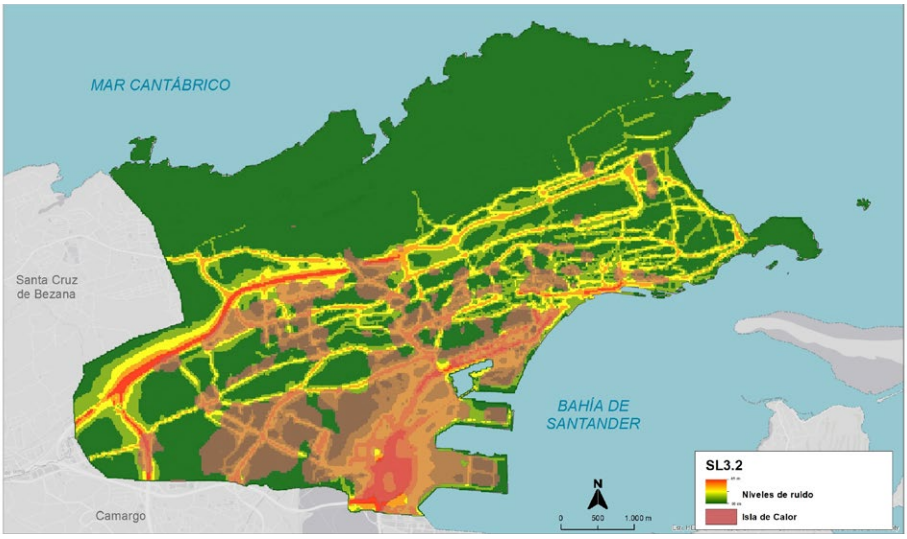
Reduction of road traffic in urban heat islands SL3.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Heat waves	Neighbourhood

MISSION OF THIS MEASURE

Establish a network of park-and-ride car areas and limit vehicle access to areas identified as urban heat islands at least during periods of intense heat.

FIGURE SL3.2. Areas of high vehicle concentration in urban heat islands



Source: CINCc (UC) - FIC, 2024 based on data from MER 2016

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,15

FOR MORE INFORMATION

Reference: Planificación para la reducción de la isla de calor en Valencia

More information at: https://www.valencia.es/documents/20142/424002/Estrategia%2520Valencia%25202020.pdf/45a6bf21-6304-7509-c717-ea0e105de538

MONITORING INDICATORS

No. of vehicle traffic management protocols in periods of intense heat (vehicles/hour)

No. of park-and-ride car areas

Proportion of use of combustion vehicles and non-polluting and non-heat emitting vehicles

Length (m) (km) of roads incorporated into the control network for extreme events

Preventive control of heat island impact on elderly people

SL3.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, health	Neighbourhood

MISSION OF THIS MEASURE

Design preventive care checks for the elderly in their own homes in action plans relating to the impact of heat and epidemic situations.

FIGURE SL3.3. Care for the elderly

Source: CINCc (UC), 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,15

FOR MORE INFORMATION

Reference: Plan Nacional de Actuaciones Preventivas de los Efectos del Exceso de Temperaturas sobre la Salud. (Ministerio de Sanidad, 2022)

More information at: https://www.sanidad.gob.es/areas/sanidadAmbiental/riesgosAmbientales/calorExtremo/publicaciones/planesAnteriores/docs/PlanNacionalExcesoTemperaturas_2022.pdf

MONITORING INDICATORS

No. of hospitalisations of elderly people in periods of extreme heat

Information programmes on heat wave prevention

SL3.4

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Education	Heat waves, health	Municipal

MISSION OF THIS MEASURE

Develop preventive health education programmes aimed at vulnerable people in order to avoid risk situations in the event of heat waves (physical exercise, dehydration, etc.).

FIGURE SL3.4. Prevention outreach programmes

Source: Ministerio de Derechos Sociales y Agenda 2030.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,08

FOR MORE INFORMATION

Reference: Protocolo general de actuación en el ámbito educativo andaluz no universitario ante Heat waves o altas temperaturas excepcionales. (Junta de Andalucía, 2023).

More information at: https://www.juntadeandalucia.es/educacion/portals/delegate/content/a9cb922b-91ab-4cd3-8d82-ac3c6a96518a/Protocolo%20ola%20calor%20y%20altas%20temperaturas%202023

MONITORING INDICATORS

No. of programmes disseminating information on preventive activities against Heat waves

Occupational heat risk mapping

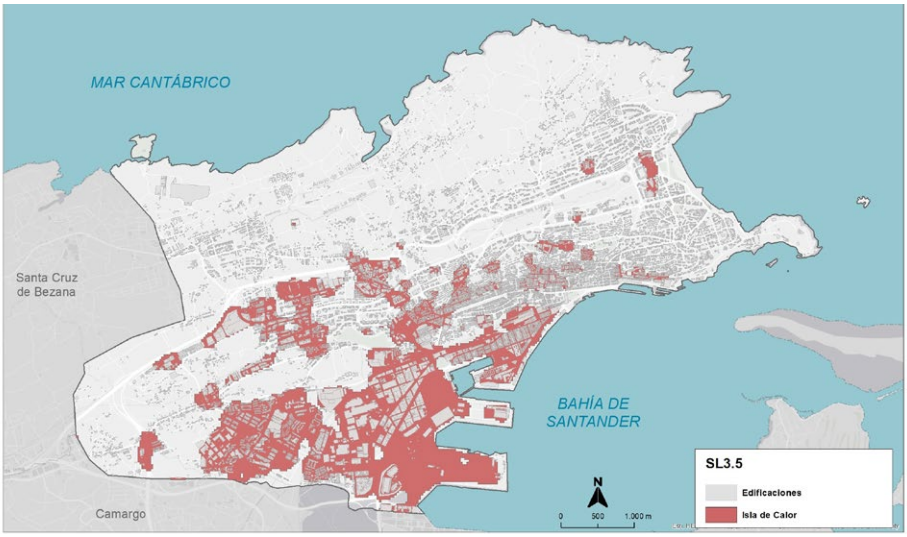
SL3.5

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Heat waves	Municipal

MISSION OF THIS MEASURE

Ensure occupational health by identifying areas and workplaces subject to increased heat stress, enabling more frequent rotations.

FIGURE SL3.5. Built-up areas in urban heat island sectors



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,85

FOR MORE INFORMATION

Reference: Rastreador de calor y salud. (CDC, 2024)
More information at: https://ephtracking.cdc.gov/Applications/heatTracker/

MONITORING INDICATORS

No. of people and workplaces in heat stress conditions
No. of hospitalisations per year due to extreme heat wave effects

Studies on heat vulnerable groups

SL3.6

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Policies	Health	Municipal

MISSION OF THIS MEASURE

Encourage the development of studies on vulnerable groups that define the risk associated with the absence of thermal comfort, taking into account their health profiles, co-morbidities and socio-economic situations.

FIGURE SL3.6. Thermal comfort in public spaces

Source: Getty Images (CC).

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 6,85

FOR MORE INFORMATION

Reference: El calor extremo no afecta a todos por igual: deja más muertes en barrios con menos recursos. (Zafra, J.L. 2020)

More information at: https://valenciaplaza.com/calor-extremo-puede-acelerar-deterioro-cognitivo-poblacionesvulnerables

MONITORING INDICATORS

No. of people identified as being vulnerable to heat

Objective SL.4: **Reduce the negative environmental factors affecting health**

Objective SL.4 focuses on reducing the negative environmental factors that affect health, for which it is effective to carry out an exhaustive analysis of mortality and morbidity in the population associated with climatic conditions, providing key information to develop effective strategies to help mitigate and reduce the adverse effects on health.

With regard to noise pollution, it is necessary to implement measures to reduce its impact through the use of low-noise gardening machinery and the creation of green barriers in sectors with high noise exposure. Noise pollution not only affects people's hearing health, but can also have negative repercussions on mental health, sleep and general quality of life, as well as on biodiversity.

Blue infrastructures, such as natural and artificial bodies of water, can be harnessed as therapeutic spaces to promote well-being and health. Thalassotherapies, which involve the therapeutic use of seawater and its derivatives, are an example of how these infrastructures can be used to promote health. Santander, as a historic spa town, has important resources in this area that should be used efficiently, especially in view of the increase in global temperatures.

It is also necessary to resize the urban sanitation sections to avoid the accumulation of stagnant water that encourages the development of pathogens and favours the appearance of outbreaks of water-related diseases. One possible measure involves improving rainwater and wastewater management, ensuring adequate drainage and preventing contamination of drinking water sources.

So in order to reduce the negative environmental determinants affecting health, it is necessary to carry out detailed analyses of risk factors and to develop targeted and effective interventions. Developing measures to reduce noise pollution is also suggested, take advantage of blue infrastructures to promote well-being, along with improving water management and urban sanitation to prevent water-related diseases.

The main measures proposed for Objective SL.4 are the following:

SL.4.1 Studies on mortality and morbidity associated with climatic conditions
SL.4.2 Reduction of noise pollution in gardening
SL.4.3 Blue infrastructure as a therapeutic and wellness space
SL.4.4 Resizing of urban sanitation infrastructures

Studies on mortality and morbidity associated with climatic conditions

SL4.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Education	Health	Municipal

MISSION OF THIS MEASURE

Analyse and study mortality and morbidity in the population associated with climatic conditions in order to mitigate and reduce their effects.

FIGURE SL4.1. Health and Climate Studies

Source: Getty Images (CC).

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,00

FOR MORE INFORMATION

Reference: El cambio climático está detrás de casi el 40% de las muertes por calor. (National Geographic, 2024)

More information at: https://www.nationalgeographic.com.es/ciencia/el-cambio-climatico-esta-detras-de-casi-el-40-de-las-muertes-por-calor-_16979

MONITORING INDICATORS

No. of deaths associated with climatic processes

No. of pathologies influenced by climatic conditions

Reduction of noise pollution in gardening

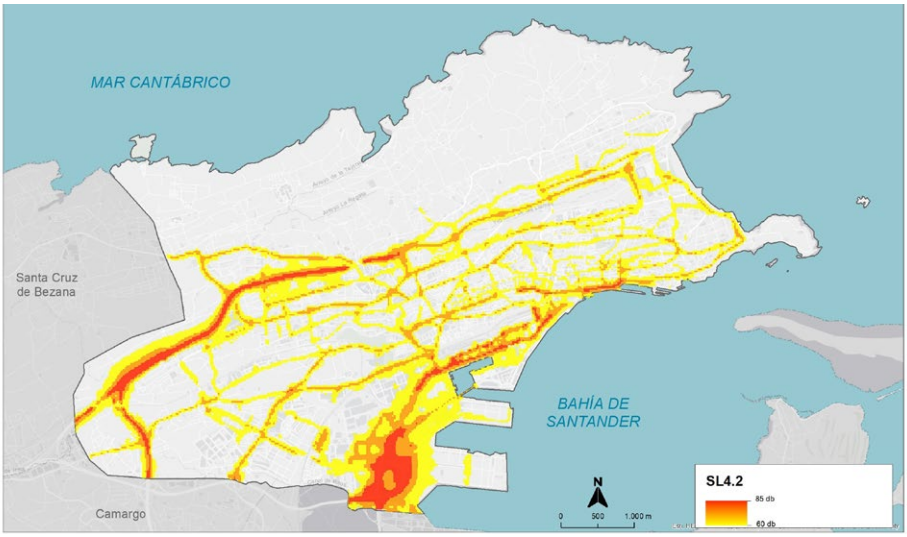
SL4.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Constructive	Heat waves, health	Municipal

MISSION OF THIS MEASURE

Reduce noise pollution through the use of low-noise gardening machinery and green screening in areas of high noise exposure due to their impact on health and biodiversity.

FIGURE SL4.2. Noise pollution areas



Source: CINCc (UC) - FIC, 2024 based on data from MER 2016

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,69

FOR MORE INFORMATION

Reference: Guía técnica para la gestión del ruido ambiental en las administraciones locales (Diputación Foral de Bizkaia).

More information at: https://www.bizkaia.eus/home2/archivos/DPTO9/Temas/Pdf/RUIDO/RUIDO%20DEF/3C%20GUIA%20TECNICA%20RUIDO%20AMBIENTAL%20AYUNTAMIENTOS_DFB.pdf?hash=1fa615ea97ca2134b5d9943ccb4bf075&idioma=EU

MONITORING INDICATORS

Budget for low-noise gardening equipment

No. of low noise impact gardening equipment / Total no. of equipment

Blue infrastructure as a therapeutic and wellness space

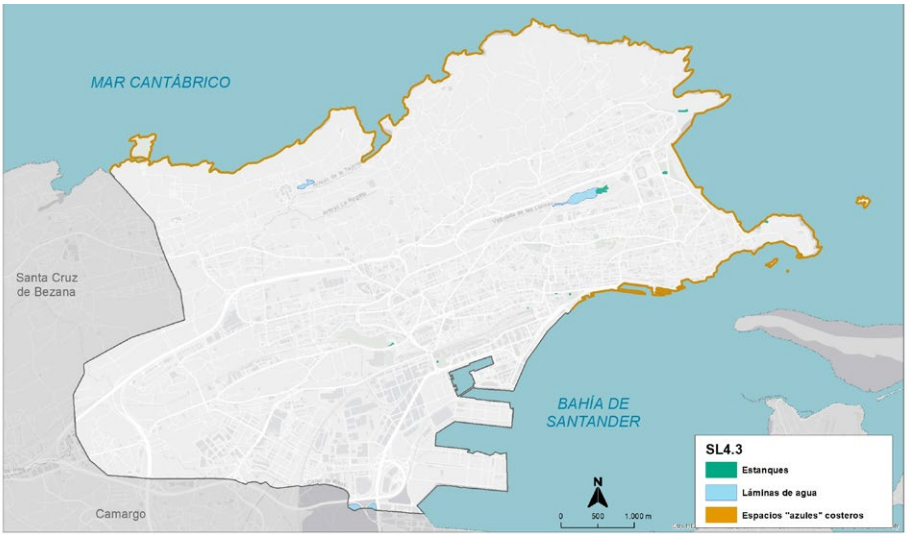
SL4.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Health	Municipal

MISSION OF THIS MEASURE

Use blue infrastructures as therapeutic, healing and wellness areas (promotion of thalassotherapy).

FIGURE SL4.3. Blue infraestructures



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,31

FOR MORE INFORMATION

Reference: Infraestructura Verde-Azul de Bizkaia (Diputación de Bizkaia, 2023)
More information at: https://www.bizkaia.eus/es/cambio-climatico/infraestructura-verde-azul

MONITORING INDICATORS

Area (m^2) blue infrastructure identified as therapeutic spaces / Blue Infraestructure surface

Resizing of urban sanitation infrastructures

SL4.4

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Constructive	Heat waves, pluvial flooding, drought	Neighbourhood

MISSION OF THIS MEASURE

Resize urban sanitation sections to avoid stagnant water that can support the growth of pathogens and outbreaks of water-associated diseases.

FIGURE SL4.4. Works to improve the sewerage network

Source: CINCc (UC), 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 6,92

FOR MORE INFORMATION

Reference: Vietnam invierte 4.300 millones de euros en 38 nuevas plantas de tratamiento de aguas residuales en Hanói. (iAgua, 2023)

More information at: https://www.iagua.es/noticias/saneamiento/13/06/03/vietnam-invertira-4300-millones-de-euros-en-38-nuevas-plantas-de-tratamiento-de-aguas-residuales-e

MONITORING INDICATORS

Length (m) (km) of strategic sanitation network resized for extreme events

ADAPTED SOCIETY AND ECONOMY GOAL

The Adapted Economy and Society Goal seeks to increase the adaptive capacity of the socio-economic fabric in the face of climate change, ensuring public awareness and monitoring of impacts in order to be prepared for, and respond effectively to extreme events. To achieve this, it is necessary to develop comprehensive actions that address both awareness, preparedness and adaptation of various sectors of society.

First, public awareness of climate change and its impacts must be ensured by conducting public awareness and education campaigns on risks and necessary adaptation measures. In addition, information and communication programmes should be developed to promote understanding of the implications of climate change and encourage public participation in adaptation. Citizens should be prepared to respond to extreme events through the implementation of emergency plans and action protocols.

These plans should include prevention, early warning, evacuation and crisis management measures, involving different actors and sectors of society in their implementation. Updating the Municipal Emergency Plan to new climate scenarios could be a decisive tool. Monitoring and assessing the effect of climate change and its impacts are equally important to better understand emerging trends and risks.

Fostering a business fabric that is prepared and adapted to climate change supports economic resilience and sustainability by promoting business strategies that integrate climate considerations, and by encouraging innovation and investment in sustainable technologies and practices. Finally, promoting sustainable and climate resilient tourism is key to protecting natural resources and promoting sustainable economic development in the city of Santander. The promotion of responsible tourism practices, the diversification of tourism products and services, and the creation of climate change resilient destinations are some of the possible strategies to achieve this goal.

OBJECTIVES

SE1 Be prepared to respond to extreme events.

SE2 Monitor and assess the climate change impacts on Santander

SE3 Understanding the implications of climate change and promoting citizen participation in adaptation

SE4 Reduce social vulnerability to climate change

SE5 Promote a business fabric that is prepared and adapted to climate change

SE6 Promoting sustainable and climate change adapted tourism

Objective SE.1: Be prepared to respond to extreme events

Objective SE.1 focuses on how society should be prepared to respond to extreme events by protecting the population and minimising the adverse impacts that may arise from severe weather events. To achieve this, coordinated and planned actions are required to address different aspects of emergency management.

First, the Municipal Emergency Plan needs to be adapted to take into account expected climate variability. The document needs to be reviewed and updated to include specific response measures for extreme rainfall, heat waves and extreme wind. It is necessary to define the appropriate emergency services and establish clear protocols of action for each type of extreme event. The municipality must assume the need to invest financial resources in the development of a new document and provide the necessary corrective measures to ensure that the community security and care services are well prepared for possible extreme events.

Identifying weather shelters among open spaces and facilities is another good measure. Shelters would provide a safe place for the population in case of extreme events. In addition, providing a list of health care facilities for vulnerable people would ensure that those in need of medical care can access it quickly during emergencies. Adequate mapping of safe and accessible facilities in extreme situations should be developed and disseminated to extreme weather response services and the public.

Creating an early warning system through mobile phone applications is also an effective tool for informing the public about extreme weather events. These applications can provide the population with instant alerts and safety advice.

Establishing security capacities at events, celebrations or spaces with a high concentration of people will guarantee an effective response to extreme events, limiting the number of people allowed in a given area to avoid risky situations during weather emergencies.

Four adaptation measures are included in Objective SE.1:

SE.1.1 Adapting the municipal emergency plan to future climate risks
SE.1.2 Climate shelter mapping
SE.1.3 Mobile application for early warning system
SE.1.4 Safety capacity at public events

Adapting the municipal emergency plan to future climate risks

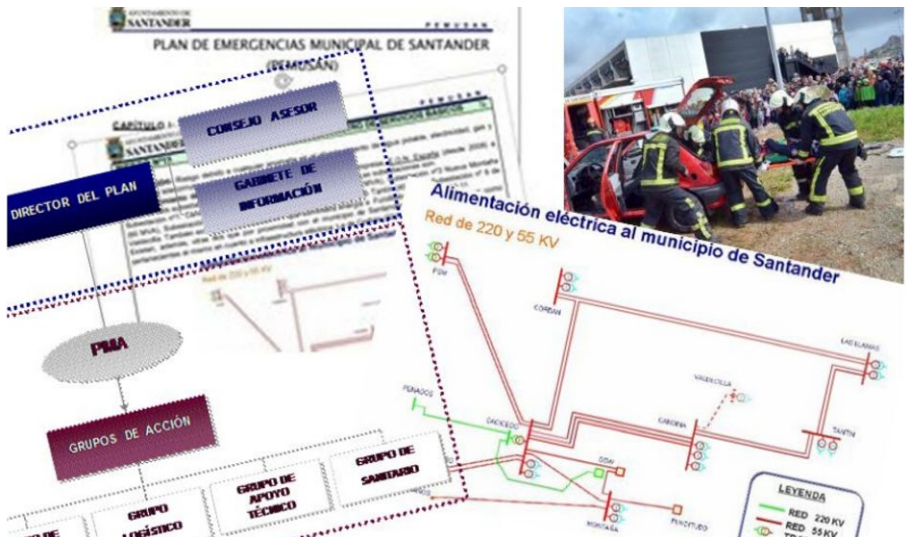
SE1.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Adapt the Municipal Emergency Plan considering the expected climatic variability, defining the appropriate emergency services in case of extreme rainfall, heat waves and extreme wind.

FIGURE SE1.1. Municipal Emergency Plan



Source: CINCc (UC), 2024, from Fire Department, Santander City Council.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 9,46

FOR MORE INFORMATION

Reference: Planes de Emergencias Municipal de Santander (PEMUSAN)
More information at: https://www.santander.es/ciudad/plan-emergencias

MONITORING INDICATORS

No. of contingency plans according to sectors adjusted to expected climate variability

Climate shelter mapping

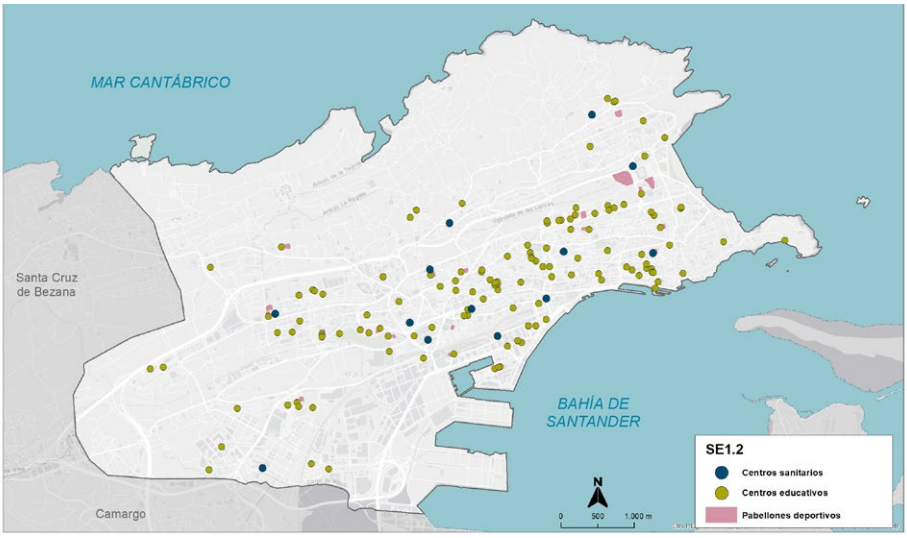
SE1.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, pluvial flooding, coastal flooding, wind, drought	Neighbourhood

MISSION OF THIS MEASURE

Identify weather shelters among the open spaces and facilities, providing a list of assistance centres for vulnerable people in case of extreme events for the information of citizens and visitors.

FIGURE SE1.2. Potential climate refuges



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,77

FOR MORE INFORMATION

Reference: 155 refugios climáticos repartidos por toda la ciudad para hacer frente al calor (Ayuntamiento de Barcelona, 2021).
More information at: https://www.barcelona.cat/infobarcelona/es/tema/emergencia-climatica/mas-de-160-refugiosclimaticos-repartidos-por-toda-la-ciudad-para-hacer-frente-al-calor-4_1083949.html

MONITORING INDICATORS

No. of climatic shelters
Total capacity of climatic shelters
Population coverage within 300 m and urban area of climate shelters

Mobile application for early warning system

SE1.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Technification	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Create an early warning system through mobile phone applications (SmartCity or other) related to extreme weather events.

FIGURE SE1.3. Civil protection alert notification

Source: CINC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,15

FOR MORE INFORMATION

Reference: Sistema de alerta integral para la adaptación al cambio climático (LIFE BAETULO, 2022)
More information at: https://adaptecca.es/sites/default/files/documentos/230220_aq_laymansreport_baetulo_es.pdf

MONITORING INDICATORS

No. of people registered in the early warning system mobile application

Safety capacity at public events

SE1.4

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, pluvial flooding coastal flooding, wind, drought	Punctual

MISSION OF THIS MEASURE

Establish safety capacities for events, celebrations or spaces with a high concentration of people in order to guarantee the response to extreme events.

FIGURE SE1.4. Mass crowds

Source: CINC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,22

FOR MORE INFORMATION

Reference: La gira de Taylor Swift en Brasil, empañada por dos muertes, varios atracos y una peligrosa ola de calor. (El Mundo, 2023)

More information at: https://www.elmundo.es/cultura/musica/2023/11/21/655c52fdfdddffd9398b459e.html

MONITORING INDICATORS

No. of annual events with concentrations above the municipal response capacity

Record of exceedance of established levels

No. of events cancelled or modified by extreme weather conditions

Objective SE.2: Monitor and assess the climate change impacts on Santander

Several measures are proposed to effectively monitor climate change and assess its impact on the city and its environment. To do this, firstly, it is necessary to develop a framework of monitoring indicators and target parameters for monitoring climate change impacts. Indicators could cover aspects such as changes in temperatures, precipitation levels, air quality, sea level, among others. These parameters would allow for systematic monitoring of climate change and evaluation of the effectiveness of implemented adaptation measures. This Adaptation Plan provides a set of indicators as a starting point for the development of an effective and adaptive monitoring tool.

Encouraging cooperation between cities through participation in networks such as the Cities for Climate Network or similar would be beneficial. Such collaborations allow for the exchange of experiences and best practices on climate change adaptation, as well as learning from strategies implemented by other cities facing similar challenges.

Creating an internal municipal body in charge of managing adaptation measures is strategic to effectively coordinate and manage climate change actions. This body would be responsible for designing and implementing adaptation policies and programmes, as well as monitoring and evaluating their impact.

It is also important to inventory potential impacts on the municipality's cultural heritage due to extreme weather events, which implies identifying cultural assets vulnerable to the effects of climate change, such as floods, coastal erosion or storms, and developing protection and conservation strategies to mitigate their deterioration.

Ensuring the monitoring and assessment of the effect of climate change therefore requires the implementation of comprehensive measures that address both climate monitoring and the assessment of its impact on the city and its heritage. By adopting a systematic and collaborative approach, the city of Santander will be better prepared to face the challenges of climate change and protect its natural and cultural environment.

For Objective SE.2, the following adaptation measures have been established:

SE.2.1 Climate impact and adaptation monitoring Indicators
SE.2.2 Exchange of experiences with other cities
SE.2.3 Municipal authority for climate adaptation
SE.2.4 Assessment of climate impacts on cultural heritage

Climate impact and adaptation monitoring indicators

SE2.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Develop a framework of monitoring indicators and target parameters for monitoring climate change impacts and progress on adaptation.

FIGURE SE2.1. Data collection of indicators

Source: CINCc (UC), 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,85

FOR MORE INFORMATION

Reference: Sistema de Información de la Agenda de Transparencia de acciones climáticas a nivel subnacional (SIAT-Subnacional). (Gobierno de México. 2020).

More information at: https://siatsubnacional.semarnat.gob.mx

MONITORING INDICATORS

No. of extreme weather events per year

No. of climate events exceeding expected thresholds

No. of adaptation measures implemented

Exchange of experiences with other cities SE2.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Education	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Encourage cooperation between cities by exchanging adaptation experiences (Cities for Climate Network, etc.).

FIGURE SE2.2. International and European institutions, associations and organisations

Source: CINCc (UC), 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,77

FOR MORE INFORMATION

Reference: (Red Española de Ciudades por el Clima y FEMP, 2024)
More information at: https://redciudadesclima.es/jornadas

MONITORING INDICATORS

No. of climate adaptation experience exchange programmes participated in
No. of adaptation projects developed in coordination with other cities and regions
No. of events - congresses for the exchange of experiences held
Funds in European programmes with an impact on urban adaptation

Municipal authority for climate adaptation

SE2.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Create an internal municipal body responsible for the management of adaptation measures.

FIGURE SE2.3. Santander City Council

Source: CINCc (UC), 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 6,85

FOR MORE INFORMATION

Reference: Comisión municipal de Medioambiente para la elaboración del Plan Municipal contra el Cambio climático de Córdoba. (Ayuntamiento de Córdoba, 2023)

More information at: https://www.cordoba.es/servicios/medio-ambiente/temas/cambio-climatico/plan-municipal-contra-cambio-climatico

MONITORING INDICATORS

No. of people involved in the development of the municipal body for adaptation

No. of adaptation measures managed by the municipal adaptation body annually

Assessment of climate impacts on cultural heritage

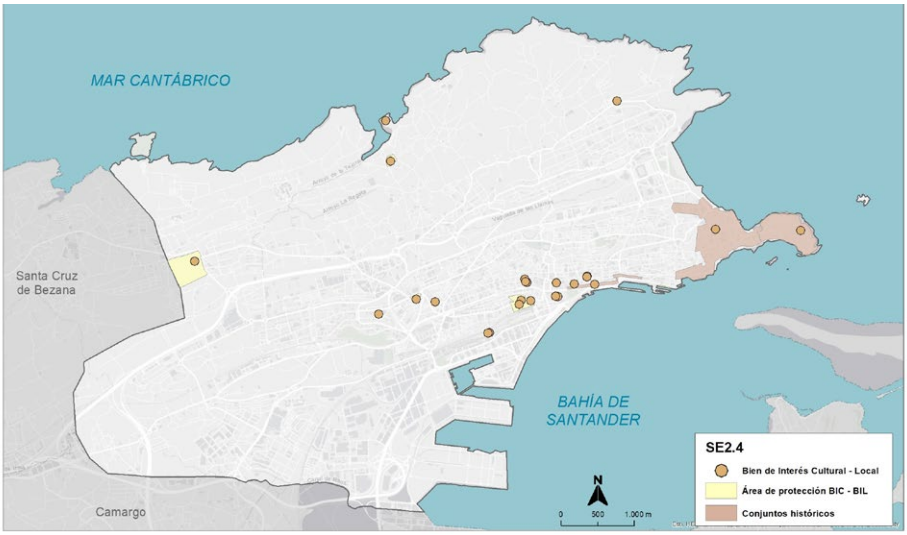
SE2.4

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Inventory the possible effects of extreme weather events on the cultural heritage of the municipality.

FIGURE SE2.4. Potential BICs and exposed historic sites



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 6,46

FOR MORE INFORMATION

Reference: Los expertos dicen que hay que vigilar el cambio climático para la conservación de Altamira. (LA INFORMACIÓN, 2018).

More information at: https://www.lainformacion.com/mundo/los-expertos-dicen-que-hay-que-vigilar-el-cambio-climatico-para-la-conservacion-de-altamira_wuvw2naozsxkomeok3un06/

MONITORING INDICATORS

No. of heritage elements exposed to extreme climatic phenomena

No. of impacts suffered due to exposure to extreme events of the inventoried assets

Objective SE.3: Understanding the implications of climate change and promoting citizen participation in adaptation

To understand the implications of climate change and encourage citizen participation in adaptation, it is important to implement various educational and awareness-raising strategies that inform and empower the population.

A first step is to carry out awareness-raising campaigns on climate change and its effects. These campaigns can use various media, such as visual information on the Santander city bus network, social networks and posters in public spaces, to convey clear and accessible information about the impacts of climate change on the city and the daily lives of its inhabitants.

It is necessary to develop a training plan on the effects of climate change aimed at different groups in society, including students, professionals and citizens in general. This training plan can include lectures, workshops and courses that address topics such as the science of climate change, exposure to climate hazards, associated risks and vulnerabilities, and necessary adaptation measures.

It is also important to articulate a technical training and awareness-raising plan specifically targeted at municipal workers, who play a key role in the implementation of adaptation and mitigation measures in the city. This training can include technical aspects related to environmental management and public policy design, as well as awareness raising on the importance of climate change and the need to act proactively.

To facilitate access to information on climate change and adaptation measures, it is necessary to set up an information point on the municipal website. This information point can provide resources such as documents, guides, links to relevant websites and updates on progress in implementing adaptation measures in the city. Complementing this information with physical signage in public places helps to reach those who cannot access information online. Thus, understanding the implications of climate change and encouraging citizen participation in adaptation requires a combination of education, awareness raising and access to information strategies.

The following adaptation measures have been identified for Objective SE.3:

SE.3.1 Information campaigns on climate change and its effects
SE.3.2 Training plan on the effects of climate change
SE.3.3 Web-based information point on climate change

Information campaigns on climate change and its effects

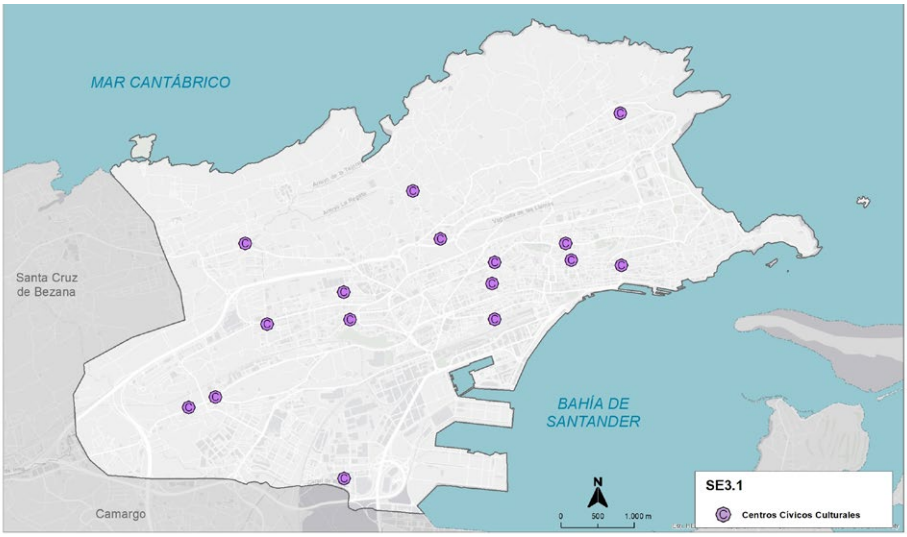
SE3.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Education	Heat waves, pluvial flooding, coastal flooding, wind, drought	Neighbourhood

MISSION OF THIS MEASURE

Develop public information campaigns on climate change and its effects.

FIGURE SE3.1. Potential information points: Civic centres



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,38

FOR MORE INFORMATION

Reference: Campañas sobre cambio climático. (Manos Unidas, 2024)
More information at: https://www.manosunidas.org/observatorio/cambio-climatico/campanas-cambio-climatico

MONITORING INDICATORS

No. of outreach campaigns
No. of outreach and awareness-raising materials

Training plan on the effects of climate change

SE3.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Education	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Articulate a technical training and awareness-raising plan for municipal workers

FIGURE SE3.2. Actions of the Santander City Council Fire Service

Source: Bomberos Ayuntamiento de Santander.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,46

FOR MORE INFORMATION

Reference: Climate change education (UNESCO, 2023)
More information at: https://www.unesco.org/en/climate-change/education

MONITORING INDICATORS

No. of training activities for staff in technical areas of the administration
No. of people benefiting from the transfer of knowledge on adaptation

Web-based information point on climate change

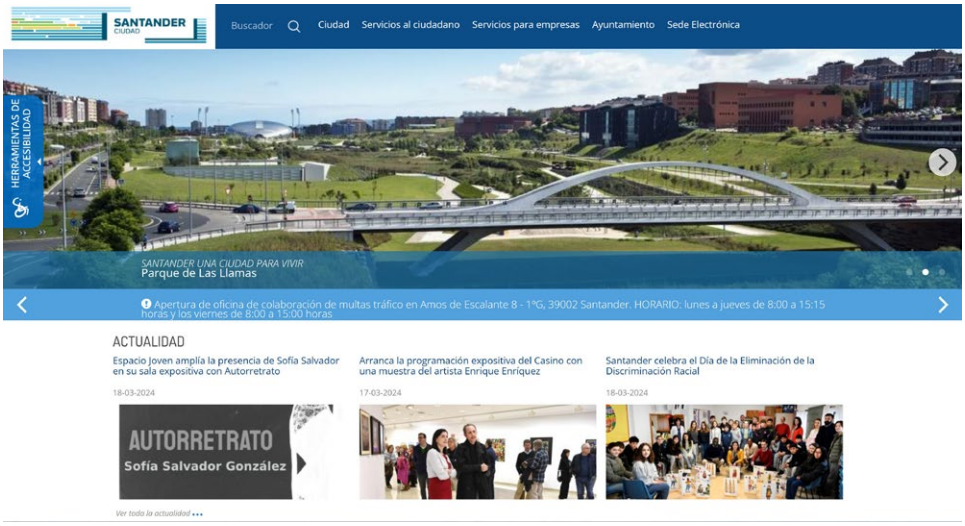
SE3.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Technification	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Enable an information point on climate change, mitigation and adaptation measures and monitoring of the progress made on the municipal website, complementary to the information on physical signage.

FIGURE SE3.3. Santander City Council website



Source: Ayuntamiento de Santander, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 6,62

FOR MORE INFORMATION

Reference: ¿Qué me ofrece AdapteCCA? (AdapteCCA, 2024)
More information at: https://adaptecca.es/

MONITORING INDICATORS

No. of visits to the climate change web section
Average time spent browsing the climate change sections of the website

Objective SE.4: **Reduce social vulnerability to climate change**

In order to reduce social vulnerability to climate change, specific measures are required to address the needs of the most affected communities. An effective strategy involves implementing programmes and policies that provide direct support to vulnerable people.

A subsidy programme for the rehabilitation of vulnerable housing is essential. This programme can provide funds to improve the energy efficiency of housing and strengthen its resilience to the impacts of climate change, such as flooding or extreme temperatures. Prioritising these grants for the homes of people with the greatest identified climate vulnerability will ensure that those most at risk receive the support they need to protect themselves. Policies to renovate the building stock should continue, not only for their effect on mitigation, but also to ensure their adaptation to future climate and its impacts.

Establishing a registry of climate-vulnerable people will identify and provide targeted assistance to those most in need. This registry can include information on the elderly, persons with disabilities, low-income families and other vulnerable populations. A dedicated municipal unit can manage this registry, ensuring the collection of relevant information, timely assistance and dissemination of information on protection and adaptation measures.

Complementarily, it is proposed to create a network of climate-adapted urban gardens as well, which can contribute to reducing social vulnerability to climate change. The gardens can be designed to withstand extreme weather conditions and provide fresh and healthy food to local communities. In addition, promoting intergenerational activities in these gardens fosters collaboration and mutual support between different age groups, thus strengthening the social fabric and community resilience.

Reducing social vulnerability to climate change requires implementing measures that address the specific needs of the most affected communities, including subsidy programmes for housing rehabilitation, establishment of registers of vulnerable people, and creation of resilient community spaces, such as climate-smart urban gardens.

Adaptation measures under Objective SE.4 are presented below:

SE.4.1 Subsidy programme for the rehabilitation of vulnerable housing
SE.4.2 List of climate-vulnerable people
SE.4.3 Network of climate-adapted vegetable gardens

Subsidy programme for the rehabilitation of vulnerable housing

SE4.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Prioritise subsidies for the rehabilitation of housing of people with identified climate vulnerability

FIGURE SE4.1. Neighbourhood of El Cabildo, Santander

Source: CINCc (UC), 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,77

FOR MORE INFORMATION

Reference: Estrategia de Rehabilitación Energética de Edificios – (Ayuntamiento de Madrid, 2023)
More information at: https://transforma.madrid.es/rehabilitacion/

MONITORING INDICATORS

Assessment of the energy performance of buildings
No. of rehabilitated dwellings
Percentage of dwellings with vulnerable people rehabilitated / Total number of vulnerable dwellings
Public funds earmarked for climate retrofitting

List of climate-vulnerable people

SE4.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Ensure the registration, assistance and information of people vulnerable to climate change through a specific municipal unit.

FIGURE SE4.2. Vulnerable groups

Source: Getty Images (CC).

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,08

FOR MORE INFORMATION

Reference: Cambio climático y salud en la ciudad de Barcelona. (Agencia de salud pública de Barcelona, 2023)

More information at: https://www.aspb.cat/noticia/canvi-climatic-salut-barcelona/

MONITORING INDICATORS

Total no. of people vulnerable to climate change identified annually

Percentage of elderly people living alone and receiving care from social services

Percentage of people receiving support for electricity supply

Network of climate-adapted vegetable gardens SE4.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Heat waves, pluvial flooding, health	Neighbourhood

MISSION OF THIS MEASURE

Create a network of climate-protected urban gardens designed to promote intergenerational activities.

FIGURE SE4.3. Urban gardens, Santander

Source: Ayuntamiento de Santander

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,08

FOR MORE INFORMATION

Reference: Lanzamos 'Semillas por el clima', un proyecto agroecológico en los centros educativos de la sierra de Madrid (La Troje – Asociación, 2022)

More information at: https://www.latroje.org/lanzamos-semillas-por-el-clima-un-proyecto-agroecologico-en-los-centros-educativos-de-la-sierra-de-madrid/

MONITORING INDICATORS

No. of people participating in the cultivation of municipal urban allotments

Total area of urban allotments / Total municipal urban population

Volume (kg) of food produced in the urban gardens / Participating people

Objective SE.5: Promote a business fabric that is prepared and adapted to climate change

In order to promote a business fabric that is prepared and adapted to climate change, various strategies focused on sustainable management and public-private partnerships should be promoted.

A first effective measure is to stimulate sustainable business management through initiatives such as certification and training programmes, as they can provide companies with the necessary tools to implement more sustainable practices in their operations, from reducing carbon emissions to the efficient management of natural resources. In addition, fostering public-private collaboration based on Corporate Social Responsibility (CSR) can help drive urban adaptation actions. This collaboration can be translated into joint projects to improve green infrastructure, promote sustainable mobility and develop innovative solutions to adapt to the impacts of climate change in Santander's urban environment.

Another important aspect is to require objective justification of the climate change benefits of eligible actions in various economic sectors. This ensures that public and private investments are directed towards projects that effectively contribute to the adaptation and mitigation of the effects of climate change.

Given the importance of the hospitality sector in the city of Santander, it is proposed to raise awareness among the population and train food handlers on conservation and the cold chain in the event of extreme heat events. Adequate training in this aspect guarantees correct food safety in adverse weather conditions, taking into consideration that there is no long-term experience in extreme heat conditions.

Fostering a business fabric that is prepared and adapted to climate change requires a combination of measures that promote sustainable management, public-private partnerships and public awareness. By promoting concrete actions in these areas, business resilience can be strengthened and contribute to building a more sustainable economy that is more resilient to the effects of climate change.

The three priority actions under Objective SE.5 are presented below:

SE.5.1 Sustainable business management incentives
SE.5.2 Incorporation of adaptation criteria in the adjudication of grants
SE.5.3 Training and awareness-raising on food preservation in extreme heat events

Sustainable business management incentives SE5.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Stimulate sustainable business management through certification and training programmes and publicprivate partnerships based on Corporate Social Responsibility aimed at promoting urban adaptation actions.

FIGURE SE5.1. Business management

Source: Getty Images (CC)

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,00

FOR MORE INFORMATION

Reference: Hacia la responsabilidad social como estrategia de sostenibilidad en la gestión empresarial. (Bom-Camargo, Y. I. 2021)

More information at: https://dialnet.unirioja.es/servlet/articulo?codigo=7927655

MONITORING INDICATORS

No. of companies with recognised environmental certifications / No. of companies in the municipality

No. of public-private partnership agreements aimed at urban adaptation

Incorporation of adaptation criteria in the adjudication of grants

SE5.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Require objective justification of the benefits provided in the fight against climate change in the eligible actions in the productive, industrial, commercial, building, tourism, etc. sectors.

FIGURE SE5.2. Control of Grants for Adaptation

Source: Getty Images (CC)

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,46

FOR MORE INFORMATION

Reference: Convocatoria de ayudas para la elaboración/actualización de los planes de acción para el clima y la energía sostenible (PACES) de los municipios de la Comunidad Valenciana. (Generalitat Valenciana, 2024)

More information at: https://www.gva.es/es/inicio/procedimientos?id_proc=G23320

MONITORING INDICATORS

Percentage of eligible actions with environmental benefits

Volume (Tn) of CO2 emissions avoided from the agreed adaptation measuresas

Training and awareness-raising on food preservation in extreme heat events

SE5.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Education	Heat waves, health	Municipal

MISSION OF THIS MEASURE

Raise public awareness and train food handlers on conservation and cold chain in the event of extreme heat events.

FIGURE SE5.3. Food handling

Source: Pixabay, Creative Commons, Zero (CC0).

PRIORITY LEVEL	**HIGH**	**MEDIUM**	**LOW**	**Value: 6,54**

FOR MORE INFORMATION

Reference: Guía Didáctica de adaptación al calor (Gobierno de España, 2020)
More information at: https://www.miteco.gob.es/content/dam/miteco/es/ceneam/recursos/materiales/guiaaclimatarnos_tcm30-540408.pdf

MONITORING INDICATORS

No. of people in the catering sector with food handling certification
No. of training and capacity building activities for professionals in the sector

Objective SE.6: **Promoting sustainable and climate change adapted tourism**

In order to promote sustainable tourism adapted to climate change, it is necessary to promote actions that promote resilience and sustainability in the tourism sector. A first action is to study the carrying capacity of certain tourism spaces and infrastructures, considering the visitor population in the face of extreme weather events. Measures of this kind make it possible to properly manage the flow of visitors and guarantee the safety and well-being of those who visit these destinations, especially in situations of climatic risk.

Developing tourism deseasonalisation campaigns to reduce pressure on destinations in times of high demand or attracting funding for projects to adapt the tourism sector to climate change can include the implementation of resilient infrastructure, the promotion of sustainable practices and the training of tourism staff in climate risk management and adaptation measures.

Implementing measures to control tourist housing in saturated areas would guarantee adequate management of real social vulnerability, which would mean establishing regulations and controls to ensure balanced and sustainable tourism development, avoiding the overexploitation of resources and the saturation of infrastructures.

Integrating risks and adaptation measures in the strategic plans dedicated to tourism in the municipality ensures effective management of climate change impacts on the sector (Ley et al., 2024). Measuring tourism indicators related to sustainability and resilience allows assessing progress and adjusting strategies as needed. Finally, stimulating the adaptation of the tourism sector in the renovation of its building stock, considering the global rise in temperatures, is key to ensure the comfort and safety of tourists in a context of climate change.

The following adaptation measures have been identified for Objective SE.6:

SE.6.1 Studies of the carrying capacity of tourist sites in the face of extreme events
SE.6.2 Tourist attraction campaigns adapted to the new climatic conditions
SE.6.3 Rising finance for the adaptation of the tourism sector
SE.6.4 Calculation of actual vulnerability in tourist residential areas
SE.6.5 Integration climate adaptation in tourism plans
SE.6.6 Stimulating the renovation of the building stock in the tourism sector

Studies of the carrying capacity of tourist sites in the face of extreme events

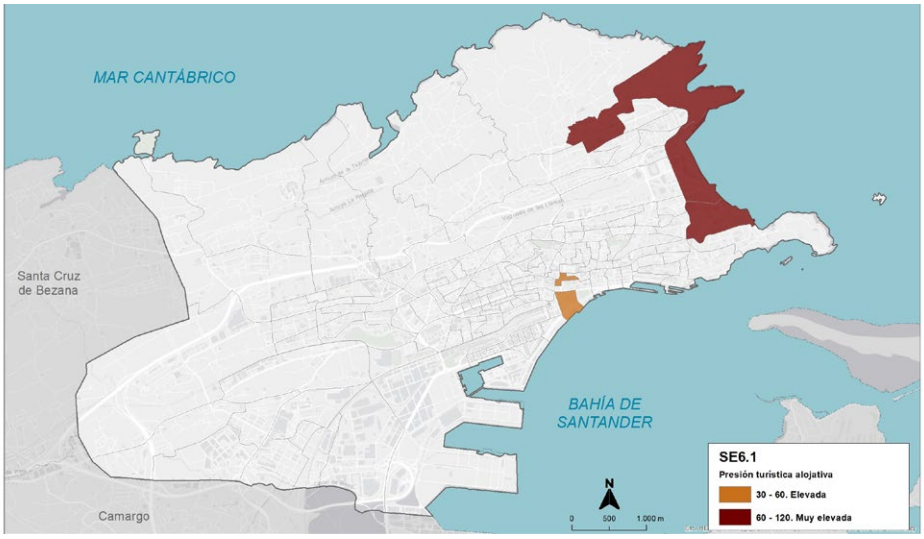
SE6.1

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Heat waves, pluvial flooding, coastal flooding, wind, drought	Neighbourhood

MISSION OF THIS MEASURE

Study the carrying capacity of certain areas and infrastructures with a high influx of tourists, considering the visiting population in the face of extreme events.

FIGURE SE6.1. Census sections with high tourist function rate



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,44

FOR MORE INFORMATION

Reference: Estudio sobre la capacidad de carga turística en Lanzarote. (Cabildo de Lanzarote, 2024) More information at: https://www.cabildodelanzarote.com/documents/35307/0/Capacidad+de+Carga+Lanzarote.pdf/b956ae9b-bcbe-f3b2-2fb6-51b25f5fa56d?t=1684154327999

MONITORING INDICATORS

No. of hotel tourist establishments / Unbuilt-up area of the census section

No. of tourist beds / Population of the census section

Tourism attraction campaigns adapted to the new climatic conditions

SE6.2

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Develop campaigns to attract visitors in the low season, encouraging the deseasonalisation of tourism in appropriate weather conditions.

FIGURE SE6.2. The main tourist attraction, El Sardinero

Source: CINCc (UC), 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,11

FOR MORE INFORMATION

Reference: El impacto del cambio climático en el turismo en España: análisis y perspectivas. (Heymann, D.A. 2024)

More information at: https://www.caixabankresearch.com/es/analisis-sectorial/turismo/impacto-del-cambio-climatico-turismo-espana-analisis-y-perspectivas

MONITORING INDICATORS

No. of tourism promotion campaigns

No. of tourism events in low season

Raising finance for the adaptation of the tourism sector

SE6.3

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Attract funding for projects to adapt the tourism sector to climate change.

FIGURE SE6.3. Tourism and Economy

Source: Getty Images (CC).

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 8,11

FOR MORE INFORMATION

Reference: Guía para inversiones adaptadas al cambio climático para un turismo sustentable y resiliente. (ADAPTUR, 2021).

More information at: https://www.unwto.org/es/covid-19-oneplanet-iniciativas-recuperacion-responsable/guia-para-inversiones-adaptadas-al-cambio-climatico

MONITORING INDICATORS

Funds earmarked for projects to adapt the tourism sector to climate change

Calculation of actual vulnerability in tourist residential areas

SE6.4

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Implement measures to control tourist housing in saturated areas to ensure that real social vulnerability is calculated.

FIGURE SE6.4. Extra - hotel accommodation

Source: CINCc (UC), 2024

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,89

FOR MORE INFORMATION

Reference: Análisis preliminar de la vulnerabilidad de la costa de Andalucía a la potencial subida del nivel del mar asociado al Cambio Climático. (Consejería de Medio Ambiente/Junta de Andalucía, 2011)

More information at: https://www.juntadeandalucia.es/medioambiente/portal/documents/20151/522644/vulnerabilidad_costas.pdf/a71d25a3-3b00-d755-4246-e2724b2b3df9?t=1402329434000

MONITORING INDICATORS

Ratio of tourists over resident population

No. of extra - hotel dwellings / No. of dwellings per census section

Integrating climate adaptation into tourism plans

SE6.5

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Planning	Heat waves, pluvial flooding, coastal flooding, wind, drought	Municipal

MISSION OF THIS MEASURE

Integrate risks and adaptation measures into the strategic plans dedicated to tourism in the municipality, incorporating the measurement of tourism indicators.

FIGURE SE6.5. Tourism Action Plan

Source: Turismo, Santander. Ayuntamiento de Santander, 2023.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 7,23

FOR MORE INFORMATION

Reference: Marco de Sendai para la Reducción del Riesgo de Desastres 2015-2030. (Naciones Unidas para la Reducción del Riesgo de Desastres (UNISDR), 2015).

More information at: https://rua.ua.es/dspace/bitstream/10045/59231/3/2016_Olcina_Vera_AnGeogrUnivComplut.pdf

MONITORING INDICATORS

No. of plans for tourism with climate adaptation criteria

Intensity of tourist use per hectare in vulnerable or exposed areas

No. of redefined tourism itineraries with future climate adaptation criteria

Stimulating the renovation of the building stock in the tourism sector

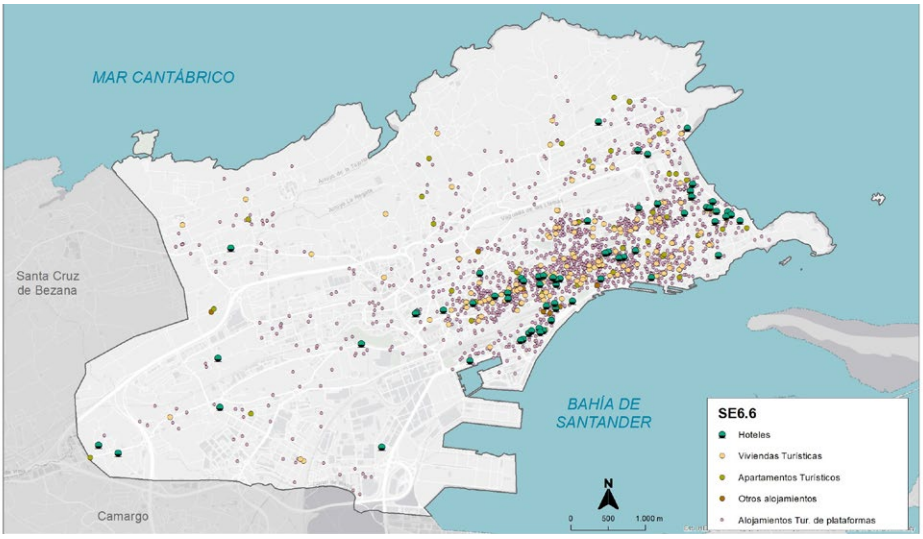
SE6.6

TYPE OF MEASURE	THREATS	TERRITORIAL REACH
Management	Heat waves, pluvial flooding	Municipal

MISSION OF THIS MEASURE

Stimulate the adaptation of the tourism sector in the renovation of its building stock, taking into account the global increase in temperatures.

FIGURE SE6.6. Location of the tourist accommodation building stock



Source: CINCc (UC) - FIC, 2024.

PRIORITY LEVEL	HIGH	MEDIUM	LOW	Value: 6,38

FOR MORE INFORMATION

Reference: Impactos, vulnerabilidad y adaptación al cambio climático en el sector turístico. (Gómez, M., 2016).

More information at: https://www.miteco.gob.es/content/dam/miteco/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/impactosvulnerabilidadyadaptacionalcambioclimaticoenelsectorturistico_tcm30-178443.pdf

MONITORING INDICATORS

Energy efficiency in the tourism sector

No. of tourist buildings renovated and adapted to new climatic conditions