



CABO DE GATA-NÍJAR NATURAL PARK - ANDLAUSIA

Identification and assessment of the
main coastal tourism-related issues
concerning climate change

The Consortium:



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Table of Contents

1.	<i>INTRODUCTION</i>	9
1.1.	Territorial Framework.....	9
1.2.	Statement. Figures of protection	10
1.3.	Physical environment.....	11
1.4.	Biotic environment.....	14
1.5.	Population and settlement system	16
1.6.	Infrastructure and equipment.....	18
1.7.	Economic activities.....	20
2.	<i>Tourism in the Cabo de Gata-Níjar Natural Park</i>	24
2.1.	Tourist typology: modalities and segments	24
2.2.	Tourist resources of the Natural Park.....	25
2.3.	Tourism infrastructure	26
2.4.	Analysis of tourism supply and demand in the NP	26
2.5.	Tourist inflow	32
2.6.	Problems, risks and needs.....	42
3.	<i>Governance of the Cabo de Gata-Níjar Natural Park</i>	44
3.1.	Key players in governance.....	44
3.2.	Governance instruments.....	44
3.3.	Alignment with regulatory frameworks	45
3.4.	Participatory and adaptive governance.....	46
4.	<i>CLIMATE DATA COLLECTION AND ANALYSIS</i>	47
4.1.	Description of data collection methods.....	47
4.2.	State of the art in climate action planning and assessment	49
4.3.	Limitations of data sources.....	51
5.	<i>HISTORICAL CLIMATE ANALYSIS AND FUTURE PROJECTIONS</i>	53
5.1.	Methodological Framework and Data Sources.....	53
5.2.	Analysis of Historical Climate Trends in the Surroundings of Cabo de Gata-Níjar Natural Park (Reference period: 1985-2014).....	54
5.3.	Analysis of past extreme weather events.	68
5.4.	Future Climate Projections for Cabo de Gata-Níjar Natural Park	72
5.5.	Final Considerations on Climate Analysis.....	77
6.	<i>RISK ASSESSMENT OF CLIMATE CHANGE IMPACTS</i>	78
6.1.	Assessment of climate change impacts in the field of tourism	79



6.2. Descriptive assessment of the main impacts of climate change in the Natural Park.....	81
7. <i>VULNERABILITY OF TOURISM ACTIVITY IN THE NATURAL PARK TO CLIMATE CHANGE</i>	87
7.1. Tourism and climate change.....	87
7.2. Evaluation of the risks associated with tourism in the municipalities of the NP area.....	89
7.3. Qualitative assessment of the main impacts of climate change and its current and future effects on tourism in the natural park.....	90
8. <i>GENERAL RECOMMENDATIONS FOR THE CLIMATE ACTION PLAN</i>	92
8.1. SELECTION OF KEY CRITERIA AND INDICATORS	92
8.2. ACTION PLAN RECOMMENDATION	92

Index of images

Map of the Cabo de Gata-Níjar Natural Park, Source: Visitor's window of natural spaces of andalusia, Consejería de Sostenibilidad y Medio Ambiente, Junta de Andalucía.....	9
Image 2. Map of mean annual temperature (°C). Source: SICMA	55
Image 3. Annual maximum temperature map (°C). Source: SICMA.....	57
Image 4. Map of minimum annual temperature (°C). Source: SICMA	59
Map of average annual precipitation (mm/day)). Source: SICMA	61
Annual reference evapotranspiration map (mm/day). Source: SICMA.....	63
Image 7. Map of number of hot days. Source: SICMA	65
Map of number of tropical nights. Source: SICMA.....	67
Image 9. Cabo de Gata campsite flooded as a result of heavy rains. Source: Rafael González (EUROPA PRESS)	71
Image 10. Effects of the DANA 2019 on the PN coastline. Source: Alfonso Rafael Viciano Martínez-Lage, Amigos del parque natural cabo de gata.....	71
Climate scenarios for mean annual temperature (°C). Source: SICMA.....	72
Climate scenarios for annual maximum temperature (°C). Source: SICMA	73
Climate scenarios for minimum annual temperature (°C). Source: SICMA	74
Climate scenarios for annual precipitation (mm/day). Source: SICMA	74
Climate scenarios for reference evapotranspiration (mm/day). Source: SICMA	75
Climate scenarios for the number of hot days. Source: SICMA	76
Climate scenarios for the number of tropical nights. Source: SICMA.....	76
Theoretical description of climate risk. Source: IPCC (ARS, 2014)	78



Flood risk due to the effect of climate change. Source: Source: Flood Risk Management Plan of the Hydrographic Demarcation of the Andalusian Mediterranean basins (2022-2027).....	82
Image 21. Floodable surface. Source: Own elaboration based on the National Floodplain Mapping System, 2025.....	83
Image 22. Desertification risk. Source: Desertification risk map. National action program against desertification. Ministry for Ecological Transition and Demographic Challenge, 2008.....	85

Index of tables

Table 1. Distribution of Companies by Economic Sector in Níjar (2022) Source: Diagnosis and measures for adaptation to climate change Níjar 2025, section 1.7.....	21
Table 2. Distribution of Companies by Economic Sector in Níjar (2022) Source: Diagnosis and measures for adaptation to climate change Níjar 2025, section 1.7.....	21
Distribution of companies by economic sector in Níjar (2022) Source: Diagnosis and measures for adaptation to climate change Níjar 2025, section 1.7.....	22
Distribution of Companies by Economic Sector in Níjar (2022) Source: Diagnosis and measures for adaptation to climate change Níjar 2025, section 1.7.....	23
Table 5. Evolution of hotel supply in Níjar and carboneras (2019-2024). Source: Own elaboration based on data from the Hotel Occupancy Survey of the National Institute of Statistics (INE).	28
Supply of tourist apartments in Níjar (2024). Source: Own elaboration based on data from the Survey of Occupancy in Extrahotel Tourist Accommodations of the National Institute of Statistics (INE).....	29
Table 7. Supply of rural accommodation on the Almeria Coast (2024) Source: Own elaboration based on data from the Rural Tourism Accommodation Occupancy Survey of the National Institute of Statistics (INE).....	30
Table 8. Evolution of the supply of Housing for Tourist Use (VUTs) in Níjar and Carboneras (2020-2024). Source: Own elaboration based on the experimental statistics on Housing for Tourist Use of the National Institute of Statistics (INE).	31
Table 9. Distribution of tourist vacancies by type and municipality in the Cabo de Gata-Níjar Natural Park (2024). Source: Own elaboration based on INE data.	32
Table 10. Governance instruments in the NP. Source. Own elaboration.....	45
Summary of climate trends under the climate scenarios analyzed (SSP2-4.5 and SSP5-8.5).....	77
Table 12. Results of the risk assessment associated with the different impacts. Source: Prepared by the authors based on various sources, 2025.	80



Table 13. Assessment of risks associated with each strategic area at the municipal level Source: Prepared by the authors based on various sources, 2025.....	88
Matrix of tourism-related risks and impacts. Source: Prepared by the authors based on various sources, 2025.	90

Index of graphs

Annual volume of foreign tourists in Níjar and Carboneras. Source: Own elaboration based on data from the experimental statistics of Measuring tourism from the position of cell phones of the INE.....	33
Graph 2. Annual volume of domestic tourists in Níjar and Carboneras. Source: Own elaboration based on data from the experimental statistics of tourism measurement from the INE cell phone position.	34
Graph 3. Seasonality of foreign tourists present in Níjar and Carboneras. Source: Own elaboration based on data from the experimental statistics of tourism measurement from the position of INE cell phones.....	35
Graph 4. Evolution of visitors at information points 2010-2023. Source: Annual Report on Activities and Results Cabo de Gata-Níjar Natural Park. 2023	41
Graph 5. Historical average temperature in Níjar. Source: SICMA	55
Graph 6. Historical average temperature in Carboneras. Source: SICMA	56
Graph 7. Historical maximum temperature in Níjar. Source: SICMA	57
Graph 8. Historical maximum temperature in Carboneras. Source: SICMA	58
Graph 9. Historical maximum temperature in Almería. Source: SICMA.....	58
Graph 10. Historical minimum temperature in Níjar. Source: SICMA	59
Historical minimum temperature in Carboneras. Source: SICMA	60
Historical minimum temperature in Almería. Source: SICMA.....	60
Graph 13. Average annual historical precipitation (mm/day) in Níjar. Source: SICMA.....	61
Graph 14. Average annual historical precipitation (mm/day) in Carboneras. Source: SICMA.....	62
Graph 15. Average annual historical precipitation (mm/day) in Almería. Source: SICMA.....	62
Graph 16. Annual reference evapotranspiration (mm/day) in Níjar. Source: SICMA.....	63
Graph 17. Annual reference evapotranspiration (mm/day) in Carboneras. Source: SICMA.....	64
Graph 18. Annual reference evapotranspiration (mm/day) in Almería. Source: SICMA.....	64
Graph 19. Number of hot days on the coast of Níjar. Source: SICMA.....	65
Graph 20. Number of hot days in the interior of Níjar. Source: SICMA	66



Graph 21. Number of hot days on the coast of Carboneras. Source: SICMA.....	66
Graph 22. Number of hot days on the coast of Almeria. Source: SICMA.....	66
Graph 23. Number of tropical nights in Nijar. Source: SICMA.....	67
Graph 24. Number of tropical nights in Carboneras. Source: SICMA.....	68
Graph 25. Number of tropical nights in Almeria. Source: SICMA.....	68
Graph 26. Evolution of mean annual temperatures in Almería. Source: Alfonso Rafael Viciano Martinez-Lage based on AEMET data.....	69
Graph 27. Forecast increase in heat waves and hot days in the province of Almería. Source: AEMET, 2018	69
Figure 28. Evolution of mean annual precipitation by decades in Almería. Source: Alfonso Rafael Viciano Martinez-Lage based on AEMET data.....	69
Figure 29. Rise in surface temperature in the Spanish Mediterranean Sea. Source: Center for Environmental Studies of the Mediterranean, 2018.....	70
Graph 30. Contribution of each municipality to the total risk for each impact. Source: Own elaboration from various sources, 2025.....	81
Graph 31. Risk assessment of the main economic sectors. Source: PAAC 2021-2030	87
Graph 32. Risk associated with each strategic area by municipality. Source: Prepared by the authors based on various sources, 2025.	88

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General description of the project

The Mediterranean region is one of the most vulnerable hotspots in the current climate and biodiversity crisis, warming 20% faster than the global average and being the world's second biodiversity hotspot. Increased severe weather events are also likely to influence the choice of destinations and timing of travel for its more than 510 million inhabitants. The effects of climate change will put additional pressure on already stressed ecosystems and vulnerable economies and societies, with tourism being one of the most affected economic sectors.

The recent Tourism Transition Pathway and the Glasgow Declaration are generating global momentum for Climate Action in Tourism, but policy makers and destinations need support to develop better efficient climate mitigation and adaptation policies using ecosystem-based approaches and improved multilevel governance structures, including sound planning, and ensuring the long-term involvement of the private sector and citizens. Indeed, ecosystem-based management is considered a good practice to effectively address these threats, as it takes into account the different actors and factors affecting ecosystems and the mechanisms involved, in order to find solutions.

NaTour4CChange builds on successful experiences at Mediterranean and global level to test solutions to increase the resilience of coastal destinations in the Mediterranean. The project will aim to establish common methods that enable participating regions to assess their tourism-related climate change adaptation and mitigation priorities, and take climate action through plans and strategies, supported by cooperative governance.

In coastal destinations, cross-sectoral teams will develop tourism-specific action plans, focusing on climate adaptation, in which nature-based solutions (NBS) will be tested to ensure their feasibility. At the same time, innovative destination marketing and communication approaches will engage private stakeholders, visitors and residents in climate action.

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



Glossary

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

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

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

Ecosystem-based approaches (EbA) focus on managing biodiversity and ecological systems holistically to maintain and enhance ecosystem services, benefits and functions.

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

1. INTRODUCTION

1.1. Territorial Framework

The Cabo de Gata-Níjar Natural Park is located in the southeast of the Spanish peninsula, within the Autonomous Community of Andalusia, specifically in the province of Almería. This protected area covers areas belonging to three municipalities: Almería, Níjar and Carboneras, forming one of the most unique ecological, scenic and geological enclaves of the European Mediterranean.

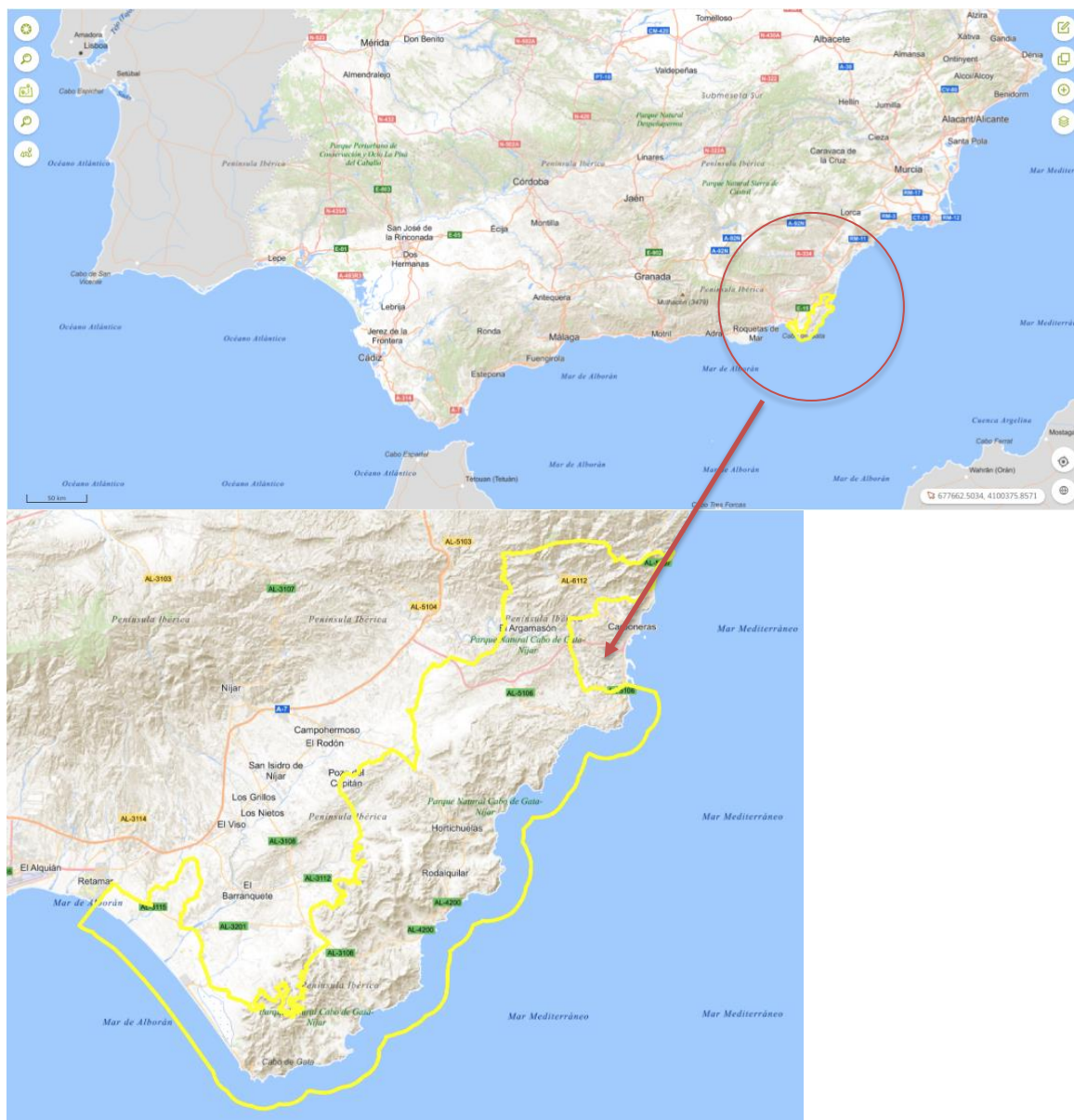


Image1. Map of the Cabo de Gata-Níjar Natural Park.source: Visitor's window of natural spaces of andalusia, Consejería de Sostenibilidad y Medio Ambiente, Junta de Andalucía.

The territorial scope of the park is defined by a total area of 49,504 hectares, of which 37,492 ha correspond to the terrestrial environment (75.7%) and 12,012 ha



to the marine environment (24.3%), thus establishing its maritime-terrestrial character. This delimitation was initially established by **Decree 314/1987, of December 23**, which declared the Cabo de Gata-Níjar Natural Park, and was subsequently clarified and ordered by **Decree 37/2008, of February 5**, which approved the Natural Resources Management Plan (PORN) and the Use and Management Plan (PRUG).

The area of socioeconomic influence of the Natural Park, defined in accordance with the provisions of Law 42/2007, of December 13, 2007, on Natural Heritage and Biodiversity, includes the entire municipalities of Almería, Carboneras and Níjar, as well as the marine area of the park located outside these municipalities. This sphere of influence covers an enlarged land area of 99,008 ha, plus 12,012 ha of marine area, for a total of 111,020 ha.

The territorial contribution of each municipality to the surface area of the park and its area of influence is unequal. Níjar represents the largest nucleus, contributing 54.5% of the surface area of the Natural Park and 54% of the area of socioeconomic influence. It is followed by Carboneras, with 14.4% of the park and 8.6% of the area of influence; and finally, the municipality of Almería, which contributes 6.8% of the surface area of the park and 26.6% of the area of influence, highlighting its relative weight outside the protected area.

From the physiographic point of view, the Park is located in a region of semi-arid characteristics, with a high ecological, geological and landscape singularity. Its delimitation includes an extensive coastal strip, with more than 63 km of cliffy coastline of exceptional environmental value, which extends offshore through seabeds of great biological richness. These characteristics have motivated not only its declaration as a Natural Park, but also its inclusion in other international protection figures, such as **Biosphere Reserve** and **UNESCO World Geopark**, which reinforces its environmental relevance in the context of the western Mediterranean.

1.2. Statement. Figures of protection

The Cabo de Gata-Níjar Natural Park, officially declared in 1987 by Decree 314/1987, of December 23, stands as the first protected maritime-terrestrial natural area of Andalusia. Since then, its ecological, geological and landscape uniqueness has led to the inclusion of the park in various regional, national and international protection figures, consolidating its status as one of the most valuable enclaves of the western Mediterranean.

The following is a list of the main protected areas that protect this natural space:

- SPECIAL AREA OF CONSERVATION (SAC) - CODE ES0000046

The Natural Park is part of the Natura 2000 Network as a Special Area of Conservation (SAC) under the code ES0000046. This designation, in accordance with the Habitats Directive (92/43/EEC), recognizes the importance of the area for the conservation of habitats and species of community interest. The Cabo de Gata-Níjar SAC covers both terrestrial and marine areas, including priority



habitats and endemic species adapted to the semi-arid conditions of the environment.

- SPECIAL PROTECTION AREA FOR BIRDS (SPA)

Since 1989, the park has been declared a Special Protection Area for Birds (SPA) under the Birds Directive (79/409/EEC). This designation highlights the area's importance for avifauna, hosting species such as the common flamingo (*Phoenicopterus roseus*), Dupont's lark (*Chersophilus duponti*) and various waders that find refuge in the park's salt flats and wetlands.

- BIOSPHERE RESERVE (UNESCO)

In 1997, UNESCO incorporated the Cabo de Gata-Níjar Natural Park into the World Network of Biosphere Reserves. This designation recognizes the harmony between biodiversity conservation and sustainable development of local communities, promoting activities compatible with the preservation of the natural and cultural values of the area.

- UNESCO GLOBAL GEOPARK

Since 2006, the park is part of the UNESCO Global Geoparks Network, highlighting its exceptional geological heritage, characterized by volcanic formations, domes and fossil beaches. This figure promotes geological education, geotourism and sustainable development based on the geodiversity of the territory.

- RAMSAR SITE - CABO DE GATA SALT FLATS

The Salinas del Cabo de Gata, with a surface area of 300 hectares, were designated in 1989 as a Ramsar Site, becoming part of the List of Wetlands of International Importance. This recognition underlines the importance of the wetland for the conservation of waterfowl and its ecological role in the region.

- SPECIALLY PROTECTED AREA OF MEDITERRANEAN IMPORTANCE (SPAMI)

In 2001, the park was included as a ZEPIM under the Barcelona Convention, highlighting its value for the conservation of marine and coastal ecosystems characteristic of the Mediterranean. This figure emphasizes the need to protect sensitive habitats and endemic species from threats such as pollution and overexploitation.

1.3. Physical environment

The Cabo de Gata-Níjar Natural Park has unique physical characteristics in the European context, derived from its geographical location, volcanic geological origin and extreme climatic conditions. These characteristics have given rise to an environment of high ecological and landscape value, where water scarcity, salinity, aridity and wind have conditioned the natural processes, human occupation and the configuration of the territory.



The information presented in this section is mainly drawn from two key territorial and environmental planning documents: the II Sustainable Development Plan for the Cabo de Gata-Níjar Natural Park (2022) and the Natural Resources Management Plan for the Cabo de Gata-Níjar Natural Park (PORN, 2022). Both instruments offer a detailed and updated diagnosis of the Park's physical environment, providing the technical and normative basis for understanding its ecological structure, its main biophysical conditioning factors and the implications for its conservation and sustainable use.

1.3.1. Climatology and night sky quality

Climatology

The Park's climate is of the dry thermo-Mediterranean type, with a semi-arid ombroclimate, far from the classic Mediterranean model. This condition is due to its geographical position, far away from the routes of the Atlantic storms, which generates a very stable thermal regime, with almost nonexistent winters and average annual temperatures ranging between 15 and 22 °C.

Rainfall is scarce and irregular, with average values between 183 mm (Cabo de Gata station) and 271 mm (Níjar). In extreme records, they can range from 37 mm/year (Cabo de Gata-Faro) to 674 mm/year (Mesa Roldán), with occasional torrential events exceeding 200 mm in a single day.

Rainfall is mainly concentrated in autumn and winter, while summers are practically dry.

Winds are a key climatic element, with an annual frequency of more than 80%, which contributes to the drying of the environment and favors erosive processes, in addition to conditioning the forms of vegetation. The predominant winds are from the east and west, and to a lesser extent the joloque (north) and leveche (southeast).

In addition, the phenomenon of "hidden precipitation", a product of the condensation of humidity on vegetation (fogs, maresía, borias), plays a vital role in the survival of many plant species, acting as an additional source of water in an extremely arid environment.

Night sky quality

The night sky of the Cabo de Gata-Níjar Natural Park is a highly valuable environmental and tourist resource. According to the regional diagnosis, more than 95% of its surface has a good or very good quality, being possible to observe the Milky Way with the naked eye in large areas. However, there are threats from light pollution from nearby urban centers, especially the capital of Almería, which underscores the need to implement sustainable lighting management strategies. The park has a high potential for the development of astro-tourism as a complementary form of sustainable tourism.

1.3.2. Geology and soil science

Geology

The park is located at the eastern end of the Betic Mountain Range and is divided into three large physiographic units:



- The volcanic Sierra del Cabo de Gata, with origins in Miocene eruptions, represents one of the most unique volcanic complexes in Europe and is associated with fossil reef formations.
- The Sierra de Cabrera and the Carboneras gypsum, formed by carbonate and micaceous materials, characterized by high slope landscapes and surface instability.
- The coastal plain of the Bay of Almeria, which preserves unique geological records of fossilized Quaternary beaches.

These geological characteristics give the park a heritage of great scientific, educational and touristic interest, which is why it was recognized as a World Geopark by UNESCO.

Soil science

The lithological diversity translates into a great variety of soils. Almost half of the typologies defined by FAO are present in the park, with the majority being poorly developed, thin, stony soils with high salinity, such as leptosols and regosols. Only a few soils in valley areas have more favorable soil conditions.

The evaluation of agrological capacity shows severe limitations to agricultural use in a large part of the territory, where soils suitable exclusively for pasture, forest conservation or natural reserves predominate. The main limitations identified are: steep slopes, shallow soil depth, salinity, rocky outcrops and low fertility.

1.3.3. Hydrology and oceanography

Hydrology

The aridity of the territory determines the lack of permanent watercourses. However, the park has several seasonal wadis and ravines. The main watercourses are the Alías River and Rambla Morales, as well as Rambla de las Negras, Rambla de las Amoladeras and Rambla de Majada Redonda.

In the hydrogeological area, two bodies of groundwater stand out:

- The Campo de Níjar aquifer, of carbonate and detrital origin.
- The aquifer of the Sierra de Cabo de Gata, of volcanic and volcano-sedimentary origin.

Both have problems of overexploitation due to the high demand for water, especially for agricultural use, which has led to the implementation of hydraulic plans such as the "Plan Almería" to improve efficiency in the use of the resource.

Oceanography

The park's coastline stretches for more than 60 km, with two distinct areas: the east coast, steep and cliffy, and the west coast, flatter and with wide sandy beaches. Opposite Cabo de Gata is the Almeria-Oran front, an area of interaction between Atlantic and Mediterranean water masses, which acts as a biogeographic border and favors marine biodiversity.

Water quality is high, due to low anthropic pressure and the existence of efficient purification infrastructures. The transparency of the water and the absence of pollution have allowed the conservation of marine ecosystems of

great value, such as the *Posidonia oceanica* meadows, some of the best preserved in the Mediterranean.

1.4. Biotic environment

The Cabo de Gata-Níjar Natural Park has a remarkable biodiversity in both terrestrial and marine areas, shaped by ecological factors such as its semi-arid climate, the geological and geomorphological complexity, and the ancestral interaction between humans and the natural environment. This uniqueness is expressed in a remarkable variety of plant formations, faunal communities and habitats of community interest.

The information collected in this section is based on the technical contents of the II Sustainable Development Plan of the Cabo de Gata-Níjar Natural Park (2022) and the Natural Resources Management Plan of the Cabo de Gata-Níjar Natural Park (PORN, 2022). Both documents are the main official references for the characterization of the biotic environment of the Park, providing an exhaustive analysis of the conservation status of its ecosystems, protected species, and ecological management priorities within the framework of the Natura 2000 Network and other applicable protection figures.

Terrestrial vegetation

The vegetation of the Cabo de Gata-Níjar Natural Park reflects an extraordinary adaptation to the extreme conditions of a semi-arid environment, marked by poor soils, low rainfall and high temperatures. The entire area is part of the thermo-mediterranean floor, with a semi-arid ombroclimate, and is home to a remarkable botanical diversity.

From a biogeographical point of view, most of the territory belongs to the Caridemo District, with the exception of the foothills of the Sierra de Cabrera, which are integrated into the Eastern Almeria District. The vegetation is grouped into two large blocks:

- **Climatophytes**, determined by the macroclimate, include the series of mastic (*Chamaeropo humilis-Rhamneto lycioidis*), cornical (*Mayteno europaei-Periploceto angustifoliae*) and jujube (*Zizipheto loti*).
- **Edaphophilic**, conditioned by soil type, including communities of salt marshes (halophytes), irrigated lands, dunes, beaches and gypsum.

The esparto grasslands are the most representative vegetation formations, fundamental to the structure and functioning of the park's ecosystems. In conditions of higher edaphic humidity, they are replaced by denser formations such as palmettos or tall shrubs. After the first rains, there are also the terophytic grasslands, with a spectacular seasonal flowering.

The Park is home to an important concentration of endemic species, many of them exclusive, such as *Anthrimum charidemi*, *Ulex canescens* and *Verbascum charidemi*. In addition, **11 species have been catalogued as vulnerable** in the Andalusian Catalogue of Threatened Species (Decree 23/2012) and two singular groves and four singular trees (two palms, an olive tree and a mastic tree) have been identified in the Inventory of Singular Trees and Groves of Almeria.



Between 2017 and 2023, the European projects LIFE Adaptamed and LIFE Conhabit were developed, focused on improving the resilience of key ecosystems such as jujube forests, restoring priority habitats and strengthening the provision of ecosystem services in the face of climate change. Their implementation has generated reference experiences for the adaptive management of Mediterranean natural areas.

Marine vegetation

More than 260 species of algae have been identified in the park's marine environment, with rhodophyceae being the most abundant group. However, the most relevant plant formations for their ecological value are the meadows of *Posidonia oceanica* and *Cymodocea nodosa*, marine phanerogams endemic to the Mediterranean.

These meadows act as authentic "underwater forests", essential for the stability of the seabed, the production of oxygen, the generation of organic matter and the refuge of diverse fauna. They are especially well developed in enclaves such as San José, Los Escullos, Rodalquilar, Las Negras and Agua Amarga.

Between 2011 and 2015, the LIFE *Posidonia* Andalucía project implemented pioneering conservation measures, including the installation of 18 ecological anchoring points in the park to avoid destructive anchoring on the meadows. These actions contributed to raising awareness among local productive sectors, such as diving tourism, and integrating them into the protection of these vulnerable habitats.

Terrestrial fauna

The mosaic of ecosystems in the Natural Park -from salt flats and steppe zones to mountain ranges, wadis and cliffs- supports a varied and specialized fauna. The terrestrial fauna of the Park is distributed in five major environments: salt pans, steppe zones, mountain ranges, river beds and coastal cliffs.

- Cabo de Gata Salt Flats: The Cabo de Gata Salt Flats are a crucial enclave for aquatic and migratory birds. They are home to species such as flamingos, avocets and stilts, and function as an area of passage between Europe and Africa. In the steppe zones, unique species such as the Dupont's lark (*Chersophilus duponti*), the little bustard and the black-bellied sandgrouse stand out.
- Steppe zones: Habitat of birds such as the Black-bellied Sandgrouse, the Little Bustard or the Dupont's Lark (*Chersophilus duponti*), a vulnerable and endemic species.
- Sierras: Rocky areas inhabited by birds of prey (Bonelli's eagle, eagle owl), carnivores such as foxes and badgers, and ungulates such as mountain goats.
- Wadis: Seasonal fluvial environments that host species such as the little plover and the leprosy terrapin.
- Cliffs: A refuge for marine species and birds such as the trumpeter finch, shag and yellow-legged gull.

Among the terrestrial invertebrates there are more than 1,600 species, with 31 endemic species, and a great variety of Coleoptera, Orthoptera and Lepidoptera, many of them exclusively represented in the southeastern Iberian Peninsula.



Many of these species are included in the National and Andalusian Catalogues of Threatened Species. Some, such as the white-headed duck or the marbled teal, are in danger of extinction. Since 2003, the Junta de Andalucía has carried out systematic censuses of these species through the wildlife monitoring program.

Marine fauna

The Park is home to a rich marine fauna, represented by almost all known groups: sponges (50 species), polychaetes (200), gastropods (300), decapods (100) and fish (more than 50 species). Among the most emblematic and protected invertebrates are the orange coral (*Astroides calycularis*), the ferruginea limpet (*Patella ferruginea*), the conch (*Charonia lampas*) and the nacre (*Pinna nobilis*), the latter currently in serious decline throughout the Mediterranean.

More than 700 species have been recorded in the marine environment, including sponges, polychaetes, gastropods, decapods and fish. Some threatened and protected species include:

- *Astroides calycularis* (vulnerable)
- *Pinna nobilis* (nacre, vulnerable)
- *Patella ferruginea* (endangered ferruginea limpet)

The artificial reef installed off Cabo de Gata more than 20 years ago is currently home to 72 species, acting as a marine refuge.

Habitats of Community Interest

The Park is home to 26 types of natural and semi-natural habitats recognized by the Habitats Directive (92/43/EEC), including four priority and five endemic habitats. The most outstanding, both for their extension and their representativeness in the Natura 2000 Network, are:

- Pre-stepic thermo-mediterranean scrub (5330)
- Substepic zones of grasses and annuals of Thero-Brachypodietea (6220)
- *Ziziphus* arborescent thickets (5220)

These habitats occupy more than 90% of the park's surface and are essential for the conservation of specialized flora and fauna. In addition, there are halophilic and coastal habitats of high ecological sensitivity.

During the execution of the LIFE Adaptamed project, pilot actions were implemented for the adaptive management of these habitats, aimed at mitigating the effects of climate change on key ecosystem services such as thermal regulation, water retention, seed dispersal or nature tourism.

1.5. Population and settlement system

The Area of Socioeconomic Influence (AIS) of the Cabo de Gata-Níjar Natural Park is made up of the municipalities of Almería, Níjar and Carboneras. This area is home to a total population of 241,093 people (2020 data), which represents approximately one third of the total inhabitants of the province of Almería. The population distribution within the AIS is markedly unequal: the municipality of Almería concentrates 83.6% of the population, followed by Níjar with 13.1% and Carboneras with 3.3%.



The information in this section has been extracted from the II Sustainable Development Plan of the Cabo de Gata-Níjar Natural Park (2022), the main reference for the analysis of the demographic structure and the pattern of human settlements in the area surrounding the park.

1.5.1. Demographic dynamics

The recent evolution of the population has been marked by sustained growth, although with different dynamics. Níjar, for example, has doubled its population in the last 30 years, largely due to the development of intensive agriculture in the Campo de Níjar and the migratory flows associated with this activity. Carboneras has also increased its population since the 1960s, in its case linked to industrial and port activity. For its part, Almería capital maintains a more moderate but continuous growth, being the economic and administrative engine of the territory.

This population growth has been accompanied by a process of relative rejuvenation in the case of Níjar, whose average age is 36.1 years, significantly lower than the provincial and Andalusian average. In contrast, Almería has a higher average age, close to 42 years. This young profile in Níjar, together with a high immigration rate (around 50% of the population is not originally from the municipality), conditions both the needs for services and the configuration of the settlement system.

1.5.2. Settlement structure

The settlement system of the AIS combines a main urban center -the city of Almería- with a network of smaller towns, cortijadas and rural outlying areas in the municipalities of Níjar and Carboneras. In total, within the Natural Park there are 18 population centers, which in 2020 totaled 4,372 registered inhabitants. The most populated are Cabo de Gata (1,356 inhabitants), San José (868 inhabitants), Pozo de los Frailes (414 inhabitants) and Las Negras (289 inhabitants).

In addition to these data, there is an unregistered but stable resident population -estimated at more than 500 people- which brings the park's actual resident population to 5,220 people. This represents less than 2% of the total population of the Area of Socioeconomic Influence, which reflects the low level of direct residential occupation within the protected area.

The population is characterized by great spatial dispersion and low density, especially in the municipalities of Níjar and Carboneras. This structure presents important challenges for the provision of basic services, mobility and sustainability of small local communities, especially in the smaller towns and in rural areas.

1.5.3. Associated problems

One of the main challenges of the AIS settlement system is the growth of informal or irregular settlements, especially in agricultural areas of the Campo de Níjar. These concentrations of substandard housing are linked to temporary and precarious employment in the agricultural sector, and pose significant



challenges from a social, environmental, health and urban planning point of view.

The pressure on the territory, the lack of adequate infrastructure and the coexistence of disparate urban planning models make it necessary to move towards a more integrated planning and management model that considers the balance between human development, environmental sustainability and territorial cohesion.

1.6. Infrastructure and equipment

This section gathers and synthesizes the information available in the II Sustainable Development Plan of the Cabo de Gata-Níjar Natural Park (2022) regarding the existing infrastructure and facilities in the area of influence of the protected area. The analysis focuses on the main systems that structure the territory -transport, water supply and purification, energy, waste management and basic public services-, as well as public use facilities linked to the conservation and enjoyment of the park. The review aims to identify strengths, shortcomings and key challenges in order to move towards a more sustainable, efficient and equitable territorial development model.

1.6.1. Transportation and mobility

The Cabo de Gata-Níjar Natural Park is located just 30 km from the capital of Almería, and its main access road is the Mediterranean Highway (A-7), which connects Almería with the rest of the Mediterranean coast. From it there are seven exits that allow access to the main population and tourist centers of the Park, such as San José, Cabo de Gata, Agua Amarga or Las Negras.

The land public transport is structured around the Metropolitan Transport Consortium of the Almeria Area. From the intermodal station of the capital, several interurban lines connect with Cabo de Gata, Níjar, San José, Rodalquilar, Las Negras or Agua Amarga. In addition, there are municipal lines, such as the circular line along the coast of Níjar, which links Campohermoso with various tourist resorts in the Park.

In high season, specific services are implemented, such as shuttle buses from San José to the beaches of Mónsul and Genoveses, in order to regulate the access of private vehicles. Despite these efforts, there are still important limitations in the coverage and frequency of public transport, especially in rural or dispersed areas.

In addition to road transport, there is a growing network of bicycle lanes and hiking routes in expansion, some integrated in initiatives such as the Andalusian Bicycle Plan or the Eje Litoral Eurovelo. In the railway field, the future Almería-Murcia high-speed railway connection is contemplated, with stops in Campohermoso and San Isidro (Níjar), although the works remained paralyzed at the date of drafting the plan.

Almeria airport, just 30 km from the park, reinforces national and international air accessibility, with direct flights to cities such as Madrid, Barcelona, London and Brussels. There are also three relevant maritime ports in the area of influence: the Port of Almería, the Port of Carboneras and the San José Marina.



1.6.2. Water cycle infrastructures

Water supply is one of the most sensitive issues in the Natural Park. The scarcity of precipitation, together with overexploitation of the aquifers, has resulted in high pressure on subway resources. Water for human consumption sometimes has taste problems, and there are deficiencies in the supply to small rural towns and scattered buildings.

Several Wastewater Treatment Plants (WWTP) serve the towns within the NP area, in many cases by means of wastewater grouping systems.

The lines of action of the PDS include the improvement of wastewater treatment infrastructures, the promotion of irrigation systems using reused water, the rehabilitation of deteriorated pipelines and the construction of desalination plants for agricultural use.

1.6.3. Energy and telecommunications

The Andalusia Energy Strategy 2020 orients territorial policies towards a model based on energy efficiency and the promotion of renewables. However, deficiencies are detected in the quality of the electricity service, especially in rural and scattered areas, as well as limitations in digital connectivity.

The PDS includes measures such as the installation of charging points for electric vehicles in public facilities and service stations, as well as the implementation of a public bicycle rental system (including electric bicycles). It also provides for the improvement of telecommunications coverage and the promotion of technological solutions adapted to rural areas.

1.6.4. Waste management

Waste management represents a major challenge, both because of the generation of agricultural waste (especially greenhouse plastics in Níjar) and because of the increase in urban solid waste during the tourist season. There are five hazardous waste facilities within the scope of the Plan, located in Almería, Níjar and Carboneras.

As for sanitation, in addition to the aforementioned WWTPs, coastal cleaning measures are carried out during the high season, covering 56 km of coastline. These actions seek to mitigate the impacts of waste, unauthorized camping and uncontrolled parking on coastal habitats.

1.6.5. Public facilities and basic services

The Natural Park has a diverse network of infrastructure for public use and social facilities. Among the tourist facilities are the Las Amoladeras Visitor Center, the El Albardinal Botanical Garden, the Ecomuseum La Casa de los Volcanes, five bird observatories in Las Salinas, multiple information points and a network of more than 15 marked trails in areas such as Los Genoveses, San Pedro, Vela Blanca or Mesa Roldán.

In terms of health care, the AIS has two health centers (Níjar and Carboneras), four clinics and twenty auxiliary clinics, integrated in the Primary Care network

of the Almería Center District. As for specialized care, services are provided at the Torrecárdenas and El Toyo hospitals.

In the educational field, Níjar has 19 centers of Infant and Primary Education, three of Secondary Education (two with special educational integration) and a Municipal School of Music. Carboneras has six centers for kindergarten and primary education, one for secondary education and a permanent education center. Almería (Retamar and Cabo de Gata area) has four public pre-schools and primary schools and a high school in Retamar.

In terms of sports facilities, Níjar leads with 79 conventional facilities, followed by Almería with 44 and Carboneras with 31. In addition, there are non-conventional facilities such as aquatic activity areas, horse riding tracks, motocross circuits and golf courses.

Finally, the territory has 110 km of cattle trails -such as the Cordel de la Campita or the Vereda de la Rambla de Belén-, which contribute to ecological connectivity as well as to the network of trails and alternative non-motorized mobility.

1.7. Economic activities

The analysis of economic activities within the Cabo de Gata-Níjar Natural Park helps to understand the socioeconomic dynamics that interact with this protected area and how these may be affected by climate change, especially in relation to the tourism sector. In order to address this issue with the necessary depth and detail, the diagnostic reports carried out by the climate change office specific to the municipalities of Níjar and Carboneras have been used. These documents provide a detailed and updated view of the productive structure and the labor market on a municipal scale, allowing a more accurate assessment of the potential impacts. The choice of these two municipalities is based on their significant territorial and socioeconomic representativeness within the Natural Park, as well as the availability of disaggregated data that allow a rigorous and relevant analysis for the objectives of this study, focused on the internal dynamics of the protected area. We have chosen to use these reports because of the relevance and specificity of the information analyzed in them, which is directly in line with the needs of this section.

In contrast, the municipality of Almería, although adjacent, represents a very minor portion of the Natural Park. For these reasons, it has been decided to focus the analysis on Níjar and Carboneras, whose data allow a more robust characterization of the economic activities of the main study area.

The municipality of Níjar: a predominantly agricultural economy with a growing service sector

The municipality of Níjar has an economic structure strongly marked by the primary sector. The following table summarizes the distribution of companies by sector in Níjar during 2022, according to the Níjar Report (section 1.7):

Economic Sector	Percentage of companies (%)
Agriculture, livestock, forestry and fishing	61,18
Trade	13,87
Real estate, professional, support, auxiliary, artistic and other service activities	7,85
Catering	6,08
Other sectors	11,02

Table1. Distribution of Companies by Economic Sector in Nijar (2022) Source: Diagnosis and measures for adaptation to climate change Nijar 2025, section 1.7.

As can be seen, the agricultural sector represents 61.18% of the total number of companies, a figure that underlines Nijar's productive specialization and places it well above the provincial (34%) and regional (16%) averages. These data translate directly into the landscape and the labor market. Intensive horticulture under plastic has established itself as the main driver of local economic development, transforming large areas of the territory and generating a considerable demand for labor. Data on the area under cultivation in 2022, extracted from the same report, indicate that arable crops occupy most of the cultivated land, with 93%, with irrigated vegetables standing out, extending over more than 6,000 hectares.

In contrast, other sectors such as commerce (13.87%), real estate and other services (7.85%), and hotels and restaurants (6.08%), have a more moderate presence, with percentages below the provincial and regional averages in most cases. This suggests a potential for growth in these areas, especially in the hotel and catering industry, which is linked to the tourist activity of the Natural Park.

The labor market in Nijar reflects this productive structure. The Nijar Report (section 1.7) indicates that more men than women are hired, with a clear sectoral segmentation. Hiring by major sectors is distributed as follows:

Contracting Sector	Percentage of Contracts (%)
Services	52,22
Agriculture and fishing	44,32
Others (Construction, Industry)	3,46

Table2. Distribution of Companies by Economic Sector in Nijar (2022) Source: Diagnosis and measures for adaptation to climate change Nijar 2025, section 1.7.

The service sector generates the most contracts (52.22%), followed closely by the agricultural sector (44.32%), which shows the importance of these activities for local employment. The foreign population plays a crucial role in the nijareño economy, with the agricultural sector being its main source of hiring,

accounting for 63.72% of the contracts of this group. It is noteworthy that the differences in hiring by gender are accentuated among the foreign population, according to the data in the aforementioned report.

The industry in Nijar has a reduced weight, focusing mainly on agri-food activities directly linked to intensive fruit and vegetable production. The Nijar Report (section 1.7) indicates that there are about 53 processing points dedicated to the handling, packaging and distribution of vegetables. Tourism, on the other hand, is considered an important sector with a notable development, centered on the Park's natural attractions.

The municipality of Carboneras: an industrial and service profile with a consolidated tourism industry

Carboneras has a markedly different economic profile, characterized by a strong industrial component and a robust service sector, where tourism plays a leading role. The distribution of companies by sector in 2022, according to the Carboneras Report (section 1.7), was as follows:

Economic Sector	Percentage of companies (%)
Industry, energy, water and waste management	26,44
Trade	21,50
Catering	15,15
Agriculture, livestock, forestry and fishing	3,31
Other sectors	33,60

Table3. Distribution of Companies by Economic Sector in Nijar (2022) Source: Diagnosis and measures for adaptation to climate change Nijar 2025, section 1.7.

The industrial sector is the most prominent in terms of the number of companies (26.44%), a figure significantly higher than the provincial (10%) and regional (7%) averages. This specialization is linked to large facilities such as the thermal power plant and the cement factory. The service sector is the second most important in terms of business fabric, with commerce representing 21.50% and hotels and restaurants 15.15%. In contrast, the agricultural sector has a very limited presence (3.31%).

The labor market in Carboneras is dominated by the service sector, as shown in the following table based on the Carboneras Report (section 1.7):

Contracting Sector	Percentage of Contracts (%)
Services	75,24

Industry	17,73
Other (Construction, Agriculture)	7,03

Table4. Distribution of Companies by Economic Sector in Níjar (2022) Source: Diagnosis and measures for adaptation to climate change Níjar 2025, section 1.7.

The service sector accounts for 75.24% of total contracts, followed at a distance by the industrial sector with 17.73%. As in Níjar, more men than women are hired, although the gap is less pronounced. For the foreign population, the service sector is the main source of hiring (82.21%).

Structural relevance of tourism in the Cabo de Gata-Níjar Natural Park.

The Cabo de Gata-Níjar Natural Park, as a protected area of high environmental and landscape value, is home to a diverse socioeconomic reality, where tourism emerges as a strategic axis for the generation of employment, territorial revitalization and the enhancement of the natural heritage. In spite of the internal differences between the municipalities that make up the Park, it is possible to identify common features that allow us to characterize the Park's tourism system as a whole.

In the study area, the economy maintains close links with the natural environment, whether through intensive agriculture, industrial activities or tourism services. These sectors, although unevenly distributed in Níjar and Carboneras, are critically dependent on the Park's environmental quality as a fundamental resource for the well-being and economic viability of their communities.

Tourism in both municipalities is a growing activity. Although its degree of consolidation varies between municipalities, its structural relevance in the business fabric and in the labor market is recognized, with important implications for adaptation to climate change.



2. TOURISM IN THE CABO DE GATA-NÍJAR NATURAL PARK

The Cabo de Gata-Níjar Natural Park has a complex and evolving tourist dynamic. Its unique landscape, derived from its volcanic origin, its semi-arid climate and the richness of its terrestrial and marine ecosystems, make it an increasingly attractive destination. This chapter characterizes tourism in this protected area, addressing its typology, the resources that support it, the supply of lodging and infrastructures, the patterns of affluence and visitor profile, as well as the problems, risks and needs identified for its sustainable management.

2.1. Tourist typology: modalities and segments

Tourism in the Cabo de Gata-Níjar Natural Park presents a remarkable diversity of modalities, although it has traditionally been dominated by the model of sun and beach tourism, driven by the scenic quality of its coastline, the conservation of its coast and the uniqueness of its unspoiled coves, many of them recognized as some of the best on the European Mediterranean coast (Consejería de Turismo, Junta de Andalucía; Destino Andalucía). However, in recent years there has been a growing interest in more sustainable and diversified forms of tourism, in line with the guidelines set out in the Andalusia Sustainable Tourism Strategy 2027 and the National Plan for Sustainable Tourism in Destinations.

Ecotourism and active tourism have experienced a progressive increase, taking advantage of the park's natural resources, its volcanic landscapes and its exceptional seabed. Activities such as hiking, bicycle tourism, bird watching, and ecological diving have consolidated their presence, thanks to the network of marked trails, the visitor center system, and the implementation of regulated public use practices, especially in areas of high ecological value (Junta de Andalucía, Red de Espacios Naturales Protegidos).

Geotourism has also emerged since 2001 as a segment with great potential, supported by the park's inclusion in UNESCO's Global Geoparks Network. The unique geological characteristics of the area -volcanic formations, domes, lava flows, fossil beaches- are integrated into educational and interpretation proposals that combine scientific dissemination with tourist experience.

On the other hand, cultural tourism offers a notable margin for development, supported by a rich ethnographic, agricultural and historical heritage. Elements such as cisterns, waterwheels, windmills, farmhouses or traditional irrigation systems reflect centuries of human interaction with the semi-arid environment. Among them, the Cortijo del Fraile stands out, known for having inspired the play *Bodas de Sangre* by Federico García Lorca, and the town of Rodalquilar, with its mining and heritage legacy. This type of resources opens the door to valorization strategies such as literary or industrial tourism, currently underdeveloped.



Finally, the Park has been the setting for more than a hundred national and international film productions, from classics such as *Lawrence of Arabia* to contemporary productions. This trajectory opens up clear opportunities for the development of film tourism, a strategic way to reinforce the identity of the destination and advance in the deseasonalization of tourism demand, in line with the recommendations of the World Tourism Organization (UNWTO) on product diversification in protected natural areas.

A relevant aspect, pointed out in the "Minutes of the I Meeting of the Cabo de Gata-Níjar Natural Park Local Action Group" (hereinafter, Cabo de Gata Taskforce Minutes, 2025), is the concern for the evolution of the visitor profile. It is noted that the growing popularity of the destination is attracting segments of tourists less aware of the fragility of the environment, whose main interest is focused on the passive enjoyment of sun and beach, which can intensify the pressure on the most sensitive ecosystems. The same source stresses the need to promote sustainable tourism and to develop strategies to attract visitors who are more respectful and committed to conservation.

2.2. Tourist resources of the Natural Park

The main tourist asset of the Cabo de Gata-Níjar Natural Park lies in its exceptional natural and scenic heritage. The "Visitor's Window" of the Junta de Andalucía highlights the 50 kilometers of cliffed coastline, the best preserved of the European Mediterranean coast, where urban beaches such as San José and Agua Amarga, natural beaches of great beauty such as Mónsul and Los Genoveses, and secluded coves such as Carnaje and Enmedio alternate. The volcanic cliffs, such as Punta de los Muertos and Mesa Roldán, offer spectacular panoramic views.

Biodiversity is another major attraction. The seabed is home to extensive meadows of *Posidonia oceanica*, submerged forests that support a rich fauna, including emblematic species such as the nacre. The practice of diving in its transparent waters is an outstanding activity in the "Visitor's Window". In the terrestrial environment, despite the aridity, there is a unique flora with more than a thousand species, many of them endemic. The salt flats of Cabo de Gata and the lagoon of Rambla Morales are key points for bird watching, with the presence of flamingos and numerous species of waders and ducks. The steppe plains of Las Amoladeras are home to an avifauna adapted to these arid conditions, such as Dupont's lark.

The cultural and ethnographic heritage complements the natural offer. The "Visitor's Window" also mentions numerous elements of interest: abandoned farmhouses that testify to a traditional culture linked to the use of resources, water collection systems such as waterwheels and cisterns, mills, ancient coastal watchtowers, and the legacy of civilizations such as the Phoenicians and Romans in the form of salting factories. The mining town of Rodalquilar and the Alumbres Castle are other relevant cultural landmarks. The need to conserve and enhance the value of this heritage is a constant in planning documents and in the conversations of local stakeholders.

2.3. Tourism infrastructure

The Cabo de Gata-Níjar Natural Park has a network of infrastructures and facilities designed to facilitate the visit and enjoyment of its natural and cultural values, as well as to organize public use. The information provided by the "Visitor's Window" of the Junta de Andalucía (consulted in May 2025) details a variety of these infrastructures:

- **Visitor Centers and Ecomuseums:** The Las Amoladeras Visitor Center (Almería), which offers an overview of the park and has adaptations for physical, visual and auditory accessibility, and the Ecomuseum La Casa de los Volcanes in Rodalquilar (Níjar), focused on geological and mining heritage, also with physical and visual accessibility.
- **Information Points:** They are distributed in strategic locations such as Isleta del Moro (Níjar), La Amatista (Níjar), Las Sirenas (Níjar), Los Muertos (Carboneras) and Rodalquilar (Níjar, with physical accessibility). These points offer orientation and basic information to visitors.
- **Signposted trails:** There is an extensive network of trails that allow you to walk through the diverse landscapes of the park. Some examples include the Caldera de Majada Redonda (Níjar), Cerro del Cinto (Níjar), Cortijo del Fraile - Montano - Hornillo (Níjar), El Pocico - Las Marinas (Almería), Escullos - Isleta del Moro (Níjar), La Molata (Níjar), Loma Pelada (Níjar), Los Genoveses (Níjar), La Molata (Níjar), Loma Pelada (Níjar), Los Genoveses (Níjar), Río Alías (Carboneras), San Pedro - El Plomo - Agua Amarga (Níjar), Vela Blanca (Níjar) and the Greenway from Lucainena to Agua Amarga (Níjar). The adequacy and maintenance of this network is essential.
- **Viewpoints:** They offer panoramic views of outstanding sites, such as the Isleta del Moro Viewpoint (Níjar, with physical accessibility), La Amatista Viewpoint (Níjar), Las Amoladeras Viewpoint (Almería) and Las Sirenas Viewpoint (Níjar).
- **Bird Observatories:** In the Cabo de Gata Salt Flats (Almería) there are several observatories (Salinas Cabo de Gata 1, 2, 3, 4 and 5) to facilitate the observation of birdlife.
- **Botanical Gardens:** El Albardinal Botanical Garden in Rodalquilar (Níjar), with physical accessibility, is dedicated to the conservation and dissemination of the flora of the Park and other arid areas of the world.

Despite this endowment, the Cabo de Gata Taskforce Act (2025) points out deficiencies, such as insufficient or confusing signage within the park, which generates disorientation among visitors and underscores the need for sustainable and effective signage, coordinated among the different administrations.

2.4. Analysis of tourism supply and demand in the NP

2.4.1 Methodology

The analysis of tourism in the Cabo de Gata-Níjar Natural Park is fundamental to understanding the possible impacts of climate change in this protected area of high ecological and landscape value. In order to carry out this study, various sources of data have been used to characterize tourism activity in the municipalities that make up the park, mainly Níjar and Carboneras.

The methodology used was based on the analysis of data from:

1. **Mobile telephony data from the INE:** These allow us to quantify the volume of people present in the municipalities, both national and international, and to analyze patterns of seasonality and interannual evolution.
2. **Hotel and non-hotel occupancy data:** These data provide information on the supply of lodging and its use.
3. **Data on Tourist Use Dwellings (VUTs):** This data allows for the analysis of the evolution and weight of this type of lodging in the territory.

It is important to note that this analysis focuses specifically on the municipalities of Níjar and Carboneras, excluding the municipality of Almería, even though a small part of the natural park is located within its administrative boundaries. This methodological decision is justified for several reasons:

1. **Territorial representativeness:** Níjar and Carboneras cover approximately 95% of the park's land area, while Almería capital includes only a small marginal portion.
2. **Concentration of tourist activity:** The vast majority of the park's tourist resources, beaches, trails, viewpoints and population centers offering lodging are located in the municipalities of Níjar and Carboneras.
3. **Statistical distortion:** Including data from Almería would significantly distort the results, since the city has its own tourism dynamics, independent of the natural park, with seasonal patterns and types of tourism that differ substantially from those of the protected area.
4. **Methodological consistency:** In order to assess the impacts of climate change on tourism in the natural park, it is more accurate to focus on municipalities whose territory and tourist activity are mostly linked to the protected area.

Therefore, Níjar and Carboneras are representative of the Cabo de Gata-Níjar Natural Park as they cover the vast majority of the protected territory, concentrate practically all of the points of tourist interest, and have an economy strongly linked to tourism in the natural park.

2.4.1. Structure of the lodging offer

This section analyzes the structure of the lodging offer in the Cabo de Gata Natural Park in four sections, corresponding to the main types of lodging:

1. Hotels
2. Tourist apartments
3. Rural lodging
4. Tourist housing (VUTs)

Hotels

In order to analyze the hotel supply, the data have the following limitations:

- For the municipality of Carboneras there are only representative data for the year 2024.

Variables	Year	Carboneras	Níjar
Estimated number of open establishments	2024	16,00	33,00
	2023	-	30,92
	2022	-	25,58
	2021	-	25,60
	2020	-	24,00
	2019	-	31,42
Estimated number of seats	2024	482,67	1378,58
	2023	-	1319,75
	2022	-	1151,08
	2021	-	1147,80
	2020	-	920,80
	2019	-	1236,58
Occupancy rate by vacancy vacancies	2024	13,53%	27,96%
	2023	-	32,34%
	2022	-	34,65%
	2021	-	39,34%
	2020	-	25,78%
	2019	-	37,54%
Staff employed	2024	25,33	141,83
	2023	-	133,08
	2022	-	142,08
	2021	-	134,40
	2020	-	93,80
	2019	-	147,83

Table5. Evolution of hotel supply in Níjar and carboneras (2019-2024). Source: Own elaboration based on data from the Hotel Occupancy Survey of the National Statistics Institute (INE).

The hotel offer in Níjar is twice that of Carboneras in number of establishments and almost three times that of Carboneras in number of vacancies. Níjar has shown an increasing evolution in the number of open establishments. In 2019 there were 31.42 establishments, a figure that decreased in 2020 with the pandemic (24 establishments) but began to recover since then. By 2024, 33 establishments are estimated to be open on average per year, which implies a complete recovery and slight growth with respect to the pre-pandemic level.

In contrast, Carboneras only has data for 2024, with 16 establishments open. This represents a starting point for future comparisons, but prevents the analysis of a historical trend for this municipality.

With respect to the number of vacancies in hotel accommodations, in Níjar, the number of tourist vacancies has increased significantly since 2020. From 920.80 bedplaces in that year, it has increased to 1378.58 in 2024, which represents a growth of 49.7% in four years. This expansion suggests an increase in accommodation capacity, probably in line with the recovery of the tourism sector.

Carboneras has 482.67 vacancies in 2024. As in the previous variable, data from previous years are not available, which limits the analysis of its evolution.

Níjar has experienced a steady decline in the average annual occupancy rate since its peak in 2021 (39.34%). In 2024, the annual average occupancy rate is 27.96%.

Carboneras, in 2024, has an occupancy rate of 13.53%, significantly lower than that of Níjar.

With respect to personnel employed in Níjar, the evolution has been relatively stable. From 93.80 people employed on average in 2020, it has risen to 141.83 in 2024, reaching one of the highest figures of the period analyzed. This indicates a strengthening of tourism employment, although with some variability: for example, in 2022 employment was higher (142.08) than in 2023 (133.08), before growing again in 2024.

Carboneras, according to the only data available for 2024, has 25.33 people employed in the sector. Although there is no temporal comparison, the difference in volume with Níjar is considerable, which is in line with the lower capacity of vacancies and establishments observed.

Apartments

The data on apartments in the available sources only have data for the municipality of Níjar, and only for the year 2024. - For Carboneras there is no data available, since it does not fall within its consideration of tourist points by the INE for this statistic.

Variables	Year	Níjar
Estimated number of vacancies	2024	573,00
Estimated number of apartments	2024	149,00
Occupancy rate by bedplaces	2024	9,13
Staff employed	2024	50,00

Table6. Supply of tourist apartments in Níjar (2024). Source: Own elaboration based on data from the Survey of Occupancy in Extrahotel Tourist Accommodations of the National Statistics Institute (INE).

In 2024, 573 vacancies are estimated in tourist apartments in Níjar. This data allows us to dimension the specific accommodation capacity of this type of establishment, which complements hotels or other forms of lodging. The

estimated number of tourist apartments in 2024 is 149 units, which indicates that they have an average size of 3.8 beds per apartment, significantly lower than the average size of hotel establishments.

The occupancy rate in 2024 is 9.13%, a lower figure compared to the 27.96% occupancy rate by hotel beds in Níjar. This could be indicative of a lower relative demand for this type of accommodation.

Finally, an estimated 50 people are employed in the tourist apartment sector in Níjar. A third of those employed in hotels.

Rural Lodging

The analysis of rural lodging in the NP presents significant limitations:

- The statistics are provided by tourist zones, not by municipalities.
- Data is only available for the Almeria Coast as a whole, with no disaggregation for Carboneras and Níjar.
- The data available are for the year 2024 only.

Variables	Year	Andalusia: Almeria Coast
Estimated number of open establishments	2024	57,33
Estimated number of vacancies	2024	382,67
Occupancy rate by bedplaces	2024	18,98
Staff employed	2024	108,33

Table7. Supply of rural accommodation on the Almeria Coast (2024) Source: Own elaboration based on data from the Rural Tourism Accommodation Occupancy Survey of the National Institute of Statistics (INE).

Rural lodging on the Costa de Almería has an average size of 6.7 beds per establishment, between the size of apartments and hotels. The occupancy rate (19.0%) is higher than that of the apartments, but lower than that of the hotels in Níjar, suggesting an intermediate position in terms of tourist preference.

The impossibility of disaggregating these data at the municipal level prevents a specific analysis for Carboneras and Níjar, limiting comparability with other types of lodging.

Tourist housing (VUTs)

The VUTs data come from the INE's experimental statistics by municipality:

- Data are available for both municipalities (Carboneras and Níjar).
- The time series is more complete, covering the period 2020-2024.

The VUTs are the type of accommodation with the largest number of vacancies in both municipalities, far exceeding the traditional hotel offer. Níjar has almost four times more VUTs than Carboneras, although the average size of the dwellings is similar in both municipalities (4.7-4.9 beds per dwelling).

Variables	Year	Carboneras	Níjar
Tourist housing	2024	253	931
	2023	235	881
	2022	209	769
	2021	187	692
	2020	183	707
Places	2024	1.195	4.528
	2023	1.123	4.332
	2022	1.018	3.815
	2021	921	3.410
	2020	905	3.534
Vacancies per tourist dwelling	2024	4,72	4,86
	2023	4,79	4,92
	2022	4,89	4,97
	2021	4,93	4,94
	2020	4,95	5,00

Table8. Evolution of the supply of Housing for Tourist Use (VUTs) in Níjar and Carboneras (2020-2024). **Source:** Own elaboration based on the experimental statistics on Housing for Tourist Use of the National Institute of Statistics (INE).

The temporal evolution shows a sustained growth in both municipalities during the period analyzed, with a total increase of 38.3% in Carboneras and 31.7% in Níjar. A drop or stagnation is observed in 2021 (possibly related to the COVID-19 pandemic), followed by a strong rebound in 2022 and 2023, and a moderation of growth in 2024.

Size and structure of the lodging supply in the NP.

The structure of the lodging supply in Cabo de Gata-Níjar Natural Park reflects an expanding tourist offer, characterized by an increasing typological diversification and a very relevant weight of Tourist Use Dwellings (VUTs). Despite the differences in territorial distribution between the two main municipalities of the NP, Níjar and Carboneras, a joint analysis allows us to identify common patterns that shape the park's lodging model.

In global terms, VUTs are the predominant modality, accounting for approximately 70% of the total number of available vacancies.



Municipality	Hotel vacancies	Vacancies in Apartments	Places in VUTs	Total Places	% of total VUTs
Carboneras	483	Not available	1,195	1,678*	71.2%*
Níjar	1,379	573	4,528	6,480	69.9%

Table9. Distribution of tourist vacancies by type and municipality in the Cabo de Gata-Níjar Natural Park (2024). Source: Own elaboration based on INE data.

Níjar is positioned as the main nucleus of the tourist offer within the Park, accumulating most of the establishments and vacancies available, both in hotels and in apartments and VUTs. This greater capacity responds to its territorial extension, diversity of natural resources and concentration of urban centers. However, Carboneras also plays a relevant role, especially in the consolidation of the VUTs and hotel accommodation, despite the limited data available.

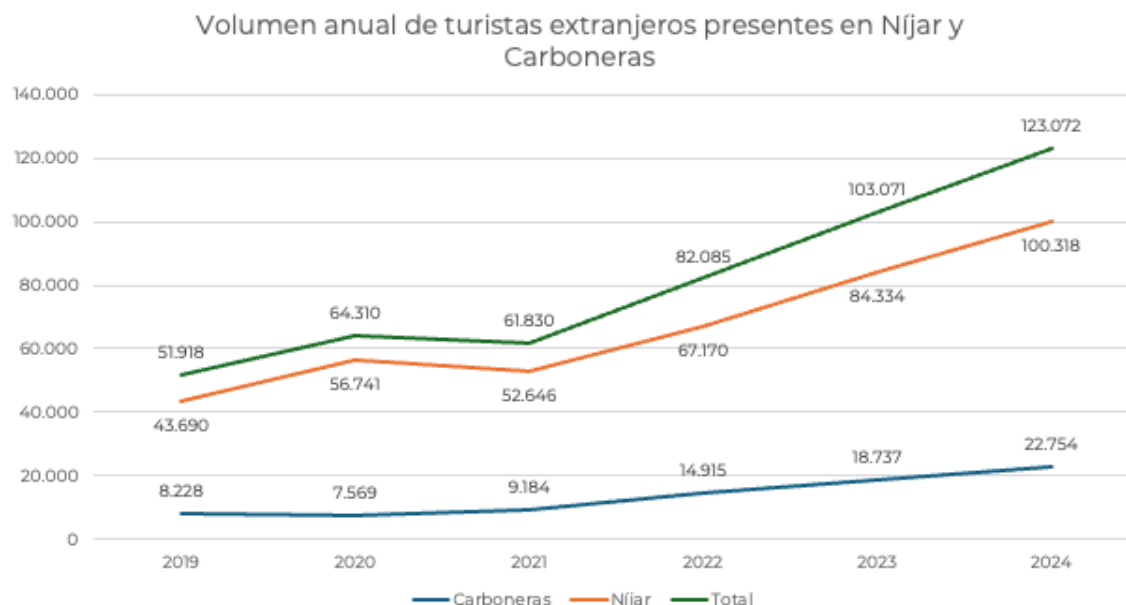
The low average occupancy recorded in some modalities, such as apartments or even hotels in Carboneras, indicates a possible underutilization of installed capacity, which may be related to seasonal factors, characteristics of demand or lack of tourism promotion in certain segments.

Overall, the park's lodging system shows a profile in transition, with a strong specialization in extra-hotel modalities and a continued growth in tourist accommodations. This panorama presents opportunities to move towards more sustainable models adapted to the protected environment by diversifying the supply, controlling the carrying capacity and improving coordination between public and private agents.

2.5. Tourist inflow

2.5.1. Annual evolution of the volume of tourists present

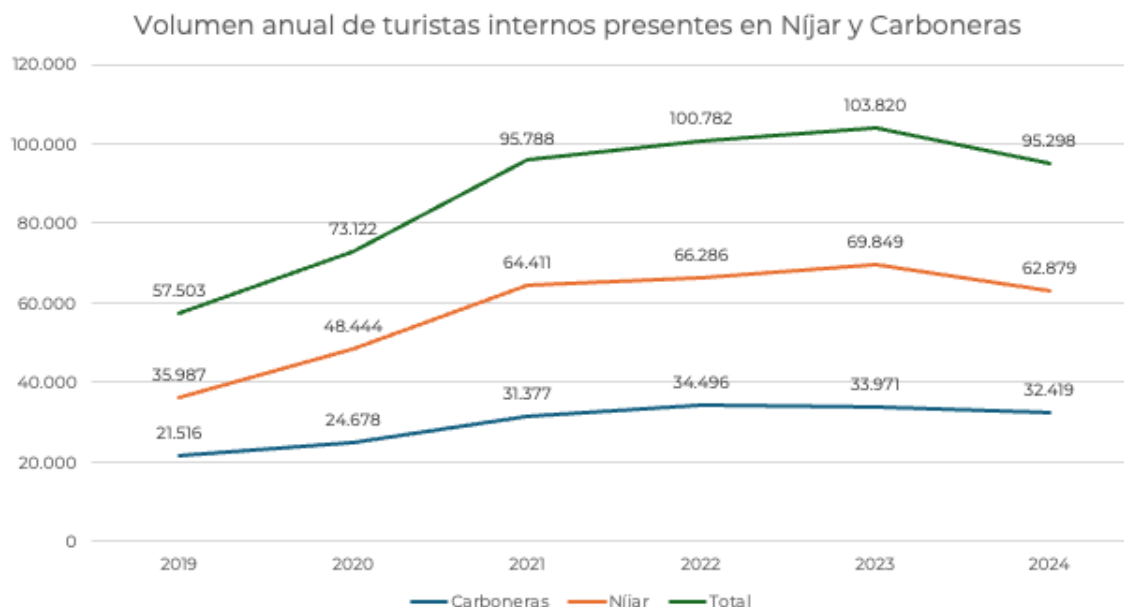
The analysis of the cell phone data provided available through the INE's experimental statistics allows us to accurately quantify the volume of tourists present in the municipalities of Níjar and Carboneras. These data, based on the position of cell phones, offer a more complete picture than traditional hotel occupancy statistics at the local level due to the limitations of statistical disaggregation of the surveys. However, these data have a limitation, and that is that this statistic starts in July 2019, so it is not possible to obtain the full year 2019.



Graph1. Annual volume of foreign tourists in Níjar and Carboneras. Source: Own elaboration based on data from the experimental statistics of Measuring tourism from the position of INE cell phones.

As can be seen in the graph, there is a marked difference in the volume of foreign tourists present between the two municipalities. Níjar receives a significantly higher number of tourists, with figures that have evolved to reach 100,318 in 2024 compared to 84,334 in 2023, which represents an annual increase of 18.95%. For its part, Carboneras presents smaller figures, going from 18,737 tourists in 2023 to 22,754 in 2024, although with an even greater percentage growth of 25.63%.

The evolution of the volume of foreign tourists present in Níjar and Carboneras shows a clear upward trend in both municipalities, although with different dynamics. Níjar starts from 43,690 tourists in the second half of 2019 and experiences a sustained growth, with the only exception of 2021, year in which it registers a slight drop of -7.22%. Since then, the number of foreign tourists present has increased significantly, reaching 100,318 in 2024, which represents more than double compared to the beginning of the series. In the case of Carboneras, from 2021 onwards, a strong recovery begins, especially highlighting the 62.40% increase in 2022. In 2024, Carboneras reaches 22,754 tourists, almost tripling the data of the second half of 2019. These data reflect a consolidated growth of tourism in both destinations, with a higher absolute volume in Níjar and a more intense acceleration in Carboneras from 2021.

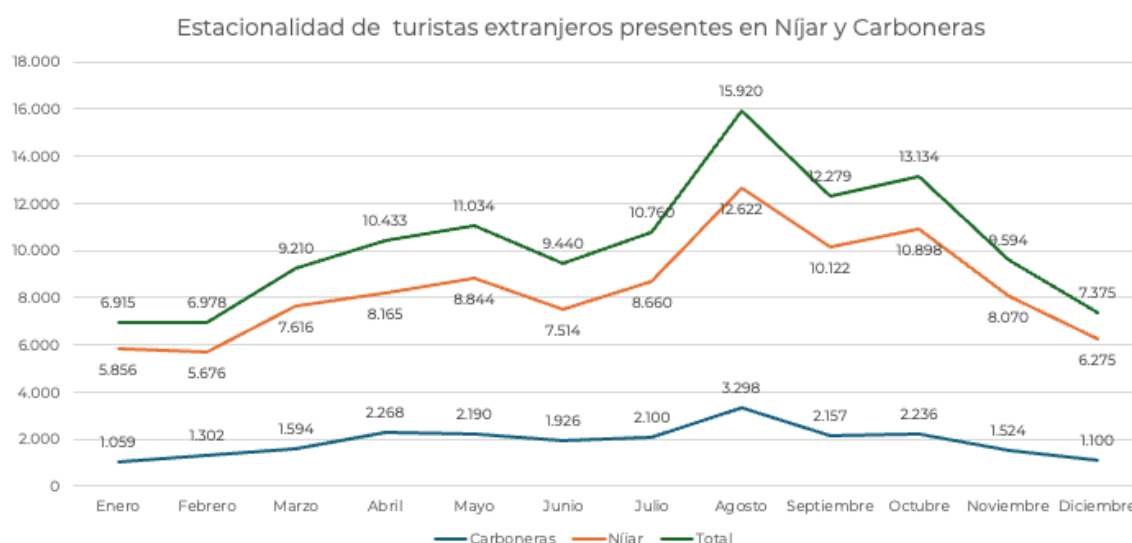


Graph2. Annual volume of domestic tourists in Níjar and Carboneras. Source: Own elaboration based on data from the experimental statistics of tourism measurement from the INE cell phone position.

The evolution of domestic tourism (people resident in Spain) in the municipalities of Níjar and Carboneras between 2019 and 2024 shows a sustained growth in both destinations. Níjar starts from 35,987 domestic tourists in the second half of 2019 and experiences a continuous increase, reaching 62,879 in 2024. Especially notable is the recovery between 2020 and 2021, where it goes from 48,444 to 64,411 tourists, consolidating the attraction of the municipality for proximity tourism in the context of the pandemic. In the case of Carboneras, domestic tourism also shows a positive evolution, starting from 21,516 tourists in the second half of 2019 and reaching 32,419 in 2024. In both municipalities, domestic tourism has been key to the resilience of the sector during the pandemic. These data reflect the consolidation of Níjar as a preferred destination for national tourists, while Carboneras maintains a positive trend, although more contained.

2.5.2. Seasonality of tourism

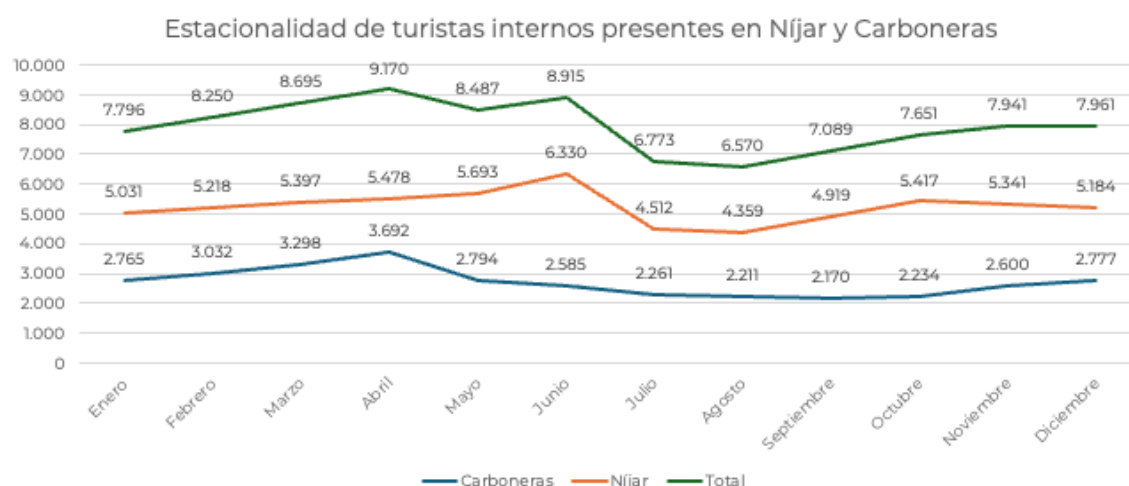
The analysis of seasonality is important to understand the temporal patterns of tourism activity and its possible vulnerability to the effects of climate change.



Graph3. Seasonality of foreign tourists present in Níjar and Carboneras. Source: Own elaboration based on data from the experimental statistics of tourism measurement from the INE cell phone position.

The graph of seasonality of foreign tourists present shows a clearly marked pattern in both municipalities, with a high season concentrated in the summer months, especially August, and a low season during the winter. Specifically taking into account the data for 2024, in Níjar, the month with the highest influx is August with a total of 12,622 foreign tourists, followed by October (10,898) and September (10,122). The month with the lowest influx is February, with 5,676 foreign tourists. In Carboneras, the pattern is slightly different, August remains as the month of greatest affluence (3,298), although as the second month of greatest affluence is more popular the entry of spring with 2,268 foreign tourists present in April. The month of April is followed by October with 2,236 foreign tourists present. On the other hand, in Carboneras it is in January where the lowest affluence is registered with 1,059 foreign tourists present in 2024.

With respect to domestic tourism, seasonality patterns change significantly in relation to foreign tourism.



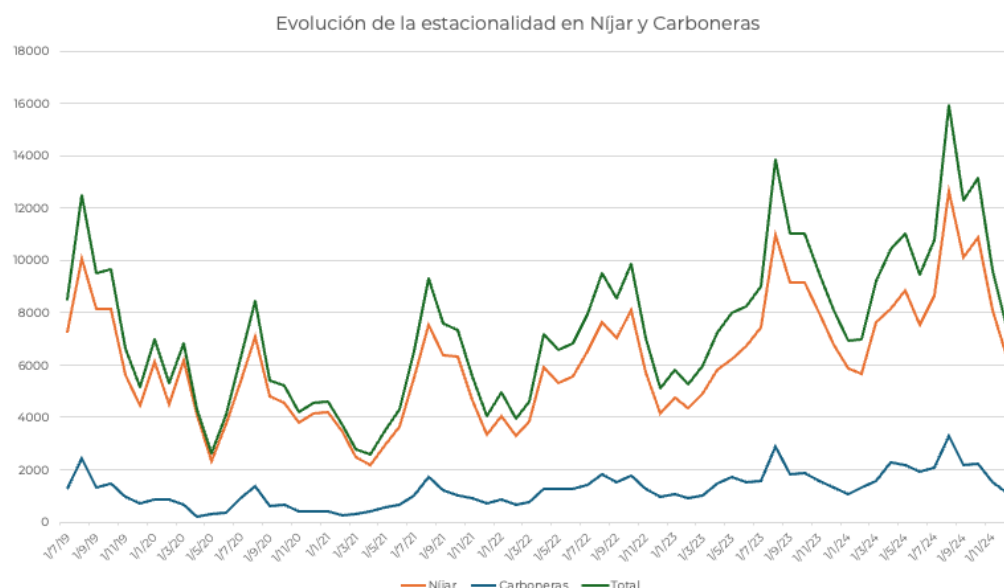
Graph 4. Seasonality of domestic tourists present in Níjar and Carboneras. Source: Own elaboration based on data from the experimental statistics of tourism measurement from the INE cell phone position.

In the case of Níjar, the data reflect a fairly balanced distribution of the flow of national tourists throughout the year. The peaks of affluence are concentrated in the months of May (5,693 tourists) and June (6,330 tourists), followed by equally high values in April (5,478) and March (5,397). Even during the traditionally more touristy months, such as July (4,512) and August (4,359), the levels remain stable, although slightly lower than in the spring months. This distribution suggests that Níjar is a destination with permanent attraction for the national tourist, possibly because of its offer linked to nature, tranquility or activities outside the conventional sun and beach tourism. In addition, autumn and winter also show a remarkable regularity, with figures exceeding 5,000 tourists in most months, highlighting November (5,341) and October (5,417).

On the other hand, Carboneras presents a more marked seasonality. Although it registers its highest figures in the spring months, with April (3,692 tourists) and March (3,298) as the months with the highest volume, a steady decline is observed from June onwards. This decline culminated in August (2,211) and September (2,170), months which, in contrast to what is expected in high season, show the lowest values of the year. This trend suggests a possible concentration of tourism supply in segments other than domestic tourism, or a lower competitiveness of the destination in the summer season. In the autumn and winter months, the values oscillate between 2,234 and 2,777 tourists, showing less regularity than in Níjar.

2.5.3. Monthly evolution and year-on-year trends

The monthly evolution of the volume of foreign tourists present allows us to observe in greater detail the trends and fluctuations over the period analyzed.

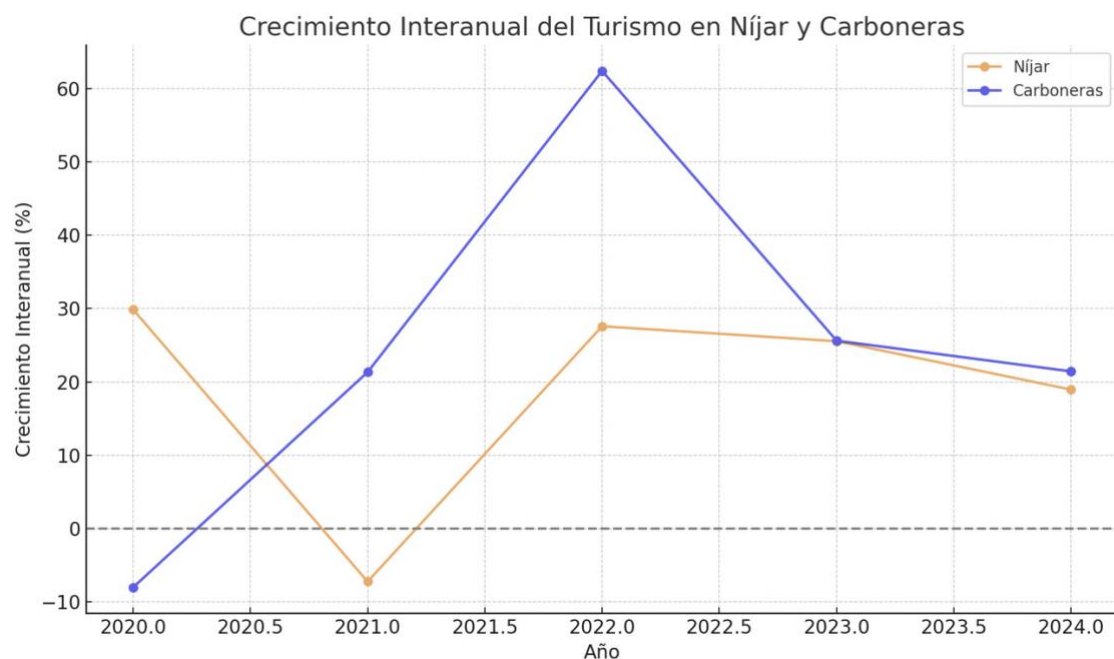


Evolution of seasonality in Nijar and Carboneras. Source: Own elaboration based on data from the experimental statistics of tourism measurement from the INE cell phone position.

The graph shows a clear upward trend in both municipalities, with seasonal fluctuations repeating year after year. A significant impact of the COVID-19 pandemic is observed during the months of confinement in 2020, with a sharp drop in April and May, followed by a relatively rapid recovery in the summer months.

From 2021 onwards, a sustained growth trend is observed, with increasingly pronounced peaks in the months of high season. The year 2024 registers the highest values of the entire series for both municipalities, indicating that the tourist attractiveness of the area continues to increase.

The analysis of the inter-annual trend shows variable growth rates. After the post-pandemic recovery in 2021 (with growth of -7.2% in Nijar and 21.3% in Carboneras compared to 2020), an acceleration of growth is observed in 2022 (27.6% in Nijar and 62.4% in Carboneras), followed by more moderate but sustained increases in 2023 and 2024.

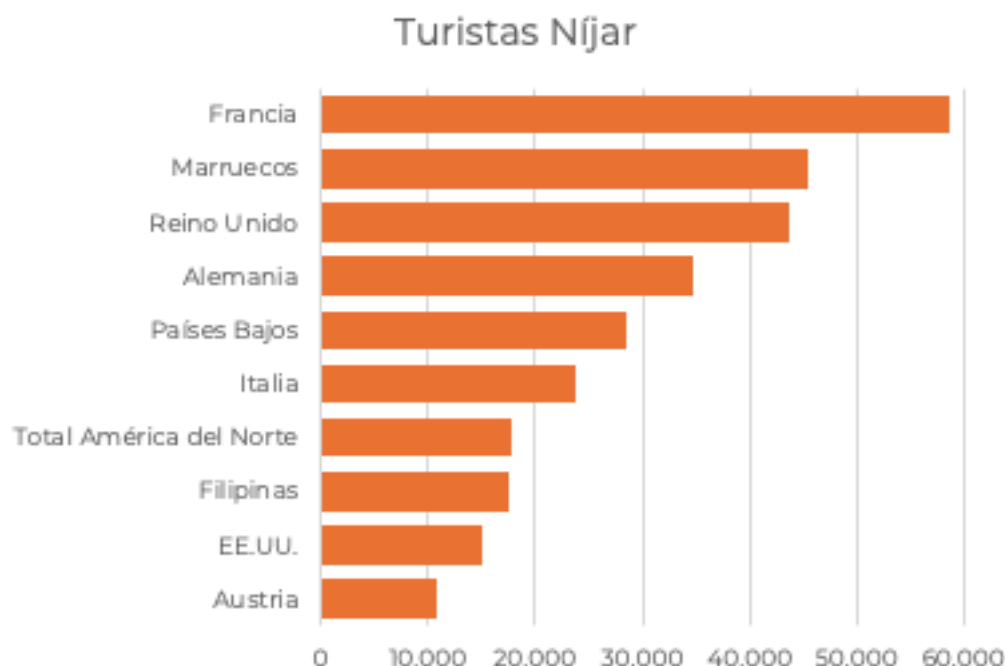


Graph 6. Interannual growth of tourism in Níjar and Carboneras Source: Own elaboration based on data from the experimental statistics of tourism measurement from the INE cell phone position.

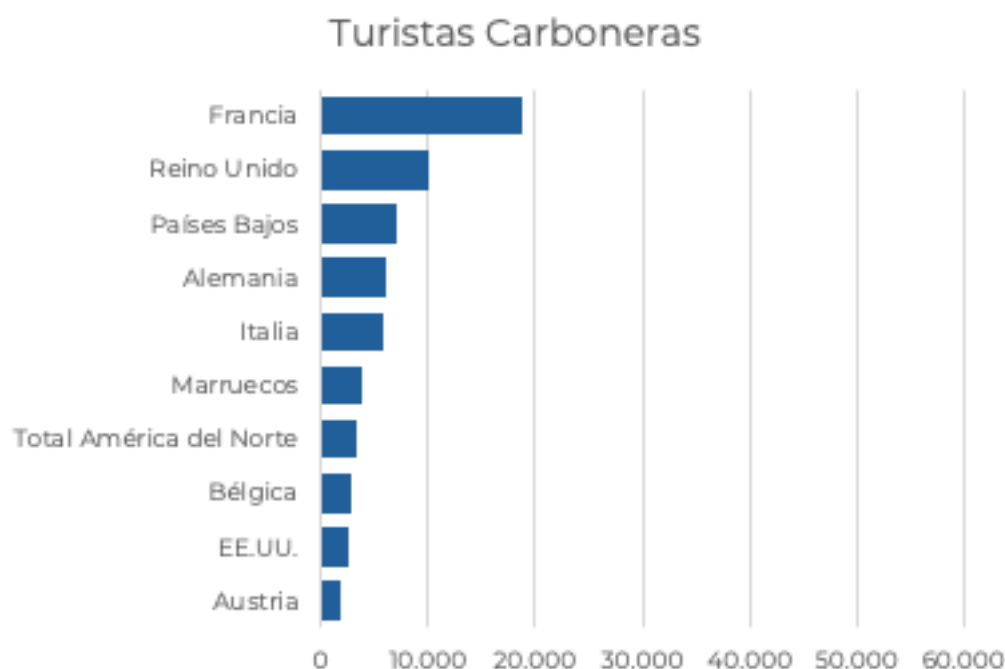
This sustained growth poses significant challenges in terms of sustainability and carrying capacity of the territory, especially in a context of climate change that could affect natural resources and the tourism experience itself.

2.5.4. Origin of tourists

In terms of inbound tourism data, in both municipalities, France is positioned as the main country of origin of international tourists, with 58,570 tourists in Níjar and 18,801 in Carboneras during the period analyzed. It is followed by Morocco and the United Kingdom in the case of Níjar, and the United Kingdom and the Netherlands in Carboneras.



Graph 7. Foreign tourists present in Níjar in 2024 by origins. Source: Own elaboration based on data from the experimental statistics of tourism measurement from the INE cell phone position.



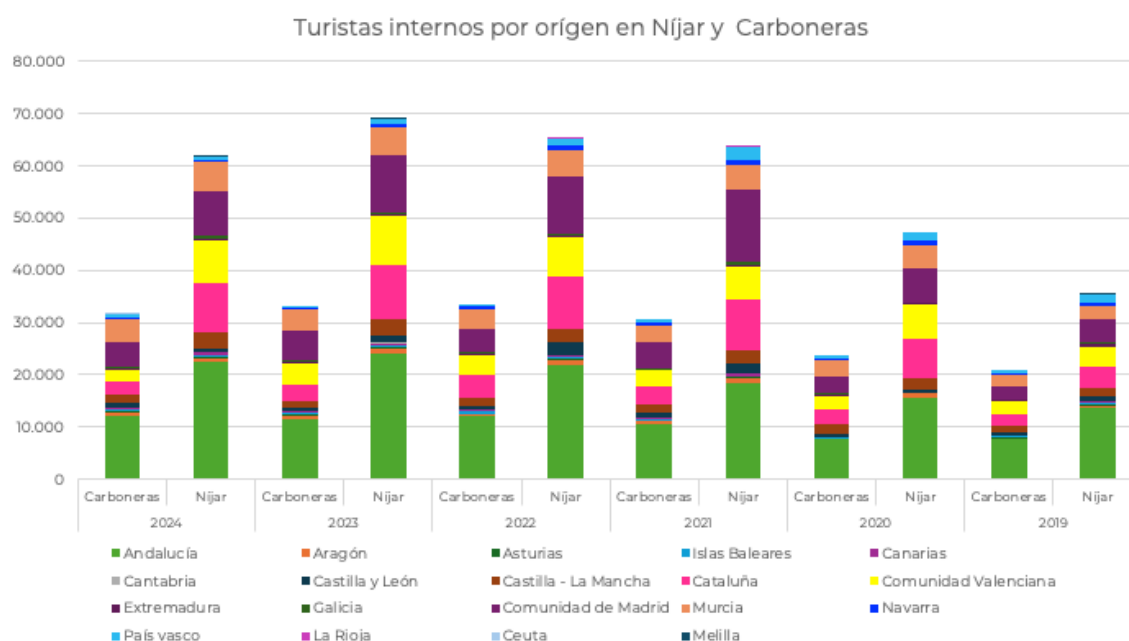
Graph 8. Foreign tourists present in Carboneras in 2024 by origin. Source: Own elaboration based on data from the experimental statistics of tourism measurement from the INE cell phone position.

It is remarkable the important presence of Moroccan tourists in Níjar (45,383), who are the second international market, probably related to historical links and geographical proximity. It is also significant the presence of tourists from

northern European countries (United Kingdom, Germany, Netherlands) in both municipalities.

The diversification of issuing markets is greater in Níjar, which receives tourists from 49 different countries, compared to the 24 countries registered in Carboneras. This greater diversification could be an advantage in terms of resilience to possible crises in specific markets.

The analysis of the origin of national tourists visiting the municipalities of Níjar and Carboneras between 2019 and 2024 reveals consistent and differentiated patterns between the two municipalities.



Graph 9. Domestic tourists present in Níjar and Carboneras in 2024 by Autonomous Region: Own elaboration based on data from the experimental statistics of tourism measurement from the INE cell phone position.

Andalusia is consolidated as the main issuing market for both municipalities throughout the period analyzed. In 2024, there were 22,431 Andalusian tourists present in Níjar, 36% of the total, and 12,162 in Carboneras, 38% of the total, confirming the predominance of local tourism driven by territorial proximity.

The Community of Madrid occupies the second position in volume of visitors, especially significant in Níjar, where it reached more than 13,800 tourists from Madrid in 2021 and although it remains the second main market, it drops to 8,306 in 2024. In Carboneras, although to a lesser extent, this market also remains stable with figures above 4,000 tourists in several years.

For their part, Catalonia and the Valencian Community are also consolidating as key markets. In Níjar, Catalonia has steadily contributed between 9,000 and 10,500 tourists per year between 2021 and 2023, while the Valencian Community remains in a range of between 7,000 and 9,000 tourists per year. In Carboneras, the figures are smaller, although stable, ranging between 2,000 and 4,000 tourists, reflecting the importance of these territories also in this municipality.

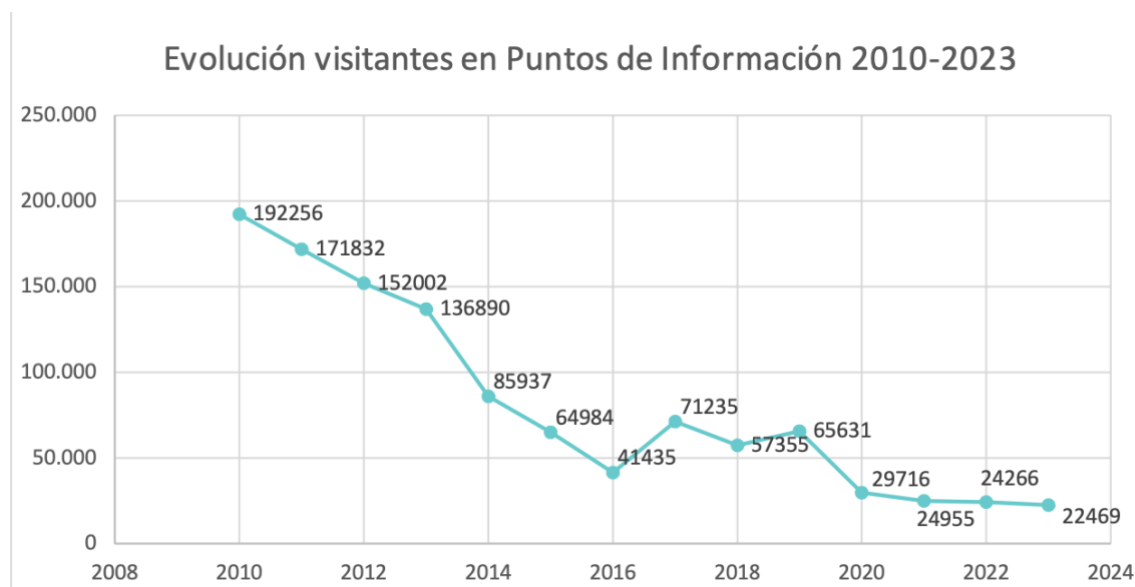
The Region of Murcia stands out for its role as a proximity market. In Níjar, it brings between 4,600 and 5,700 tourists annually since 2020, and in Carboneras between 3,000 and 4,100, consolidating itself as a recurring market in both municipalities.

Other communities such as Castilla-La Mancha, Castilla y León, Navarra and the Basque Country present more moderate but significant volumes. In Níjar, for example, the Basque Country reached 2,499 tourists in 2021 and has remained a constant market, while Castilla-La Mancha has exceeded 2,000 tourists annually since 2020.

Overall, Níjar has a significantly higher volume of domestic tourism than Carboneras in all the years analyzed, highlighting its ability to attract visitors from all over the country. Carboneras, on the other hand, shows a more marked dependence on regional tourism.

2.5.1. Evolution of visitors at the information points of the National Park

The evolution of the number of visitors to the public facilities of the Cabo de Gata-Níjar Natural Park between 2007 and 2023 provides key information to understand the tourism dynamics in this protected area. Through the data collected by the management of the NP, it is possible to identify trends, impacts and changes in the influx, as well as to evaluate the effect of external factors such as the pandemic or the closure of infrastructures. This analysis supports decision making aimed at more effective and sustainable management of public use in the park.



Graph4 . Evolution of visitors at information points 2010-2023. Source: Annual Report on Activities and Results of the Cabo de Gata-Níjar Natural Park. 2023

During the period between 2007 and 2023, the number of visitors to the public facilities of the Cabo de Gata-Níjar Natural Park has experienced an evolution marked by three distinct stages. In a first phase of growth (2007-2010), the park reached its maximum peak with 192,256 visitors in 2010, after an upward progression that began in 2007. Subsequently, between 2011 and 2016, there



was a period of sustained decline, culminating in a low of 41,435 visitors. From 2017 onwards, a slight recovery can be seen until 2019, when 65,631 people were counted.

The outbreak of the COVID-19 pandemic in 2020 caused a new change in trend, with a drop to 29,716 visitors, followed by a stagnation at low levels during the following years: 24,266 in 2022 and 22,469 in 2023. This decline is accentuated by the partial or total closure of numerous information points such as PI Isleta, PI Amapista or PI Los Muertos, which significantly reduced the park's operational capacity to serve visitors. On the other hand, centers such as CV Amoladeras and PI Las Sirenas have maintained a certain level of regularity, contributing more to the annual total.

Overall, the decrease in the number of visitors between 2019 and 2023 reflects a significant change in the dynamics of public use of the park, which invites reflection and the design of new strategies. Strengthening the interpretive offer through the progressive reopening of facilities, improving the visitor experience, and promoting environmentally friendly tourism are lines of action that could contribute positively to a gradual recovery. Coordinated management adapted to the new realities can favor greater accessibility and enjoyment of the park, while guaranteeing the conservation of its valuable natural heritage.

2.6. Problems, risks and needs

The management of tourism in a protected area such as Cabo de Gata-Níjar faces a series of complex problems, risks and needs. At the first meeting of the "Cabo de Gata Taskforce (2025)" held in February, various aspects of the current problems and concerns of different local actors and managers of the Park were discussed. These can be grouped into several axes:

- **Mobility and Access:** The large influx of private vehicles, especially in high season and at access points to popular beaches such as Agua Amarga and Cala del Plomo, generates pollution, parking problems and environmental degradation. There is a need to encourage public transport, restrict the access of polluting vehicles, promote zero-emission mobility (cycling, hiking) and install park-and-ride lots with electric shuttles (although the difficulty of ceding agricultural land for this purpose is recognized). Poor signage exacerbates mobility problems.
- **Pressure on Natural Resources and Overcrowding:** The concentration of visitors in certain areas and times of the year exerts a strong pressure on sensitive ecosystems, such as dunes (e.g., dune of Mónsul, which requires greater protection) and Posidonia meadows. Overcrowding also affects the quality of the visitor experience and neighborhood coexistence.
- **Waste Management:** The increase in visitors leads to an increase in the generation of waste, the collection system for which is considered insufficient, especially during the high season. Municipalities need to increase the number of containers and collection personnel. An additional problem is the illegal boats that transport tourists to inaccessible beaches and generate uncontrolled waste.



- **Awareness-raising and sensitization:** It is essential to raise awareness among visitors, businesspeople, and the local population about the importance and fragility of the park's ecosystem. Information campaigns and training activities are proposed.
- **Tourism Management and Heritage Protection:** There is a demand for greater control and management of tourism activities, including the restriction of vehicles in areas of high ecological value. A certification system is proposed for tourism companies that adopt good environmental practices and the enhancement of natural and cultural resources through interpreted trails and the conservation of heritage elements (Cortijo del Fraile, Castillo de los Alumbres, waterwheels, etc.) to diversify supply and contribute to seasonal diversification.
- **Planning and Governance:** The lack of coordination in the implementation of the Sustainable Development Plan is criticized, resulting in improvised decisions. The need to improve governance is emphasized, with greater interdepartmental coordination within the Junta de Andalucía and between the different administrations (Junta, municipalities) and the sectors involved (businessmen, conservation associations, neighbors) to implement access, protection and management measures in a planned and consensual manner. The consultative role of the Park's Governing Board is also mentioned as a factor to be considered in decision-making.
- **Sustainable Tourism and Diversification of Supply:** A great potential for the development of sustainable tourism is identified through the creation and improvement of networks of bicycle and pedestrian trails, the promotion of eco-friendly diving, film tourism, and the training of local guides. The diversification of the underwater offer and the improvement of tourist service guides are other proposals. ASEMPARNA suggests organizing shifts in restaurants to improve service during non-seasonal demand.

In conclusion, tourism in the Cabo de Gata-Níjar Natural Park is at a crossroads. Its undoubted attractiveness and development potential must be carefully managed to avoid degradation of its unique values and ensure long-term sustainability. This requires a coordinated, planned and participatory approach that balances the conservation of natural and cultural heritage with local socioeconomic development and the quality of the tourist experience.



3. GOVERNANCE OF THE CABO DE GATA-NÍJAR NATURAL PARK

The governance of the Cabo de Gata-Níjar Natural Park is structured around a network of institutional and social actors that articulate their action through regulatory, strategic and participatory instruments of different scopes. This structure seeks to guarantee the conservation of its natural values, the adaptation to climate change and the sustainable development of the territory.

3.1. Key players in governance

The Consejería de Sostenibilidad, Medio Ambiente y Economía Azul of the Junta de Andalucía is the main responsible for the planning, management and supervision of the Natural Park. This body prepares and executes the Natural Resources Management Plan (PORN) and the Master Plan for Use and Management (PRUG), which constitute the legal framework for the management of the area and the regulation of activities.

The Governing Board of the Natural Park, a collegiate body of a consultative and participatory nature, represents a fundamental channel for the involvement of civil society and territorial agents. In accordance with article 20.1 of Law 2/1989, of July 18, 1989, representatives of public administrations, scientific entities, environmental organizations, businessmen, and neighbors participate on the board.

Other relevant stakeholders include:

- **Town councils** of the municipalities within the Park's boundaries, involved in the promotion of local development and sustainable tourism.
- **Local landowners and users**, who participate in consultation and management processes, especially in the context of Sustainable Development Plans (SDPs) and activities promoted by the Governing Board.
- **Technical and operational personnel** at the Park's service, including public employees (civil servants and laborers), the Environmental Agents Service, personnel from the Andalusian Environment and Water Agency and workers from the public company Tragsatec.

3.2. Governance instruments

The park has a set of regulatory, strategic and operational instruments that structure its governance, classified according to their scope of application:

Scope	Instrument	Description / Function
ENP Management	PORN (Plan de Ordenación de los Recursos Naturales - Natural Resources Management Plan)	It delimits zones, establishes conservation objectives and use guidelines.
	PRUG (Use and Management Guiding Plan)	Regulates activities, determines permitted and restricted uses.
	Governing Board	A consultative and participatory body, it promotes oversight and social control.
Climate change	Municipal climate change plans	Local instruments aligned with Law 8/2018 and the PAAC 2021-2030.
	Emergency and mobility plans	They complement climate change adaptation and risk management.
Tourism	Sustainable Development Plans (SDP)	Promote tourism models compatible with conservation and resilience.
	Local or regional strategic tourism plans (in coordination with RDGs)*.	They provide guidelines for sustainable tourism development (*Pending validation).

Table10. Governance instruments in the NP. Source. Own elaboration.

3.3. Alignment with regulatory frameworks

The park's governance framework is aligned with various regulatory and strategic initiatives at the regional, national and international levels:

- **Law 8/2018 on Climate Change and Energy Transition of Andalusia**, which promotes the integration of climate action at all planning levels.
- **Andalusian Climate Action Plan (PAAC) 2021-2030**, which considers tourism as a strategic sector and prioritizes its adaptation through infrastructures and sustainable management models.
- **Andalusian Sustainable Tourism Strategy**, which reinforces the integration of climate change into tourism planning.



- **Draft Bill of the Sustainable Tourism Law of Andalusia**, chapter 8 of which promotes environmental, social and economic sustainability in the tourism sector.
- **International initiatives**, such as the *Glasgow Declaration on Climate Action in Tourism* (2021), signed by Andalusia, and the commitments derived from the *Paris Agreement* and the *Sustainable Development Goals (SDGs)*.

3.4. Participatory and adaptive governance

Following the PAAC approach, the Park's governance model promotes the active participation of local stakeholders, encouraging public consultation processes, participatory methodologies and strategic environmental assessment mechanisms. The Governing Board acts as a catalyst for these processes, facilitating transparency and inclusion in decision-making.

Inter-institutional cooperation and multilevel articulation (local, regional and autonomous) allow for better coordination of conservation, tourism and climate action policies, reinforcing the resilience of the Natural Park in the face of current and future challenges.

In this line, the LIFE ADAPTAMED project has generated valuable *Recommendations on adaptive governance in the context of climate change in LIFE ADAPTAMED sites* (November 2021), which emphasize the need to implement flexible and transparent governance structures with the active participation of all stakeholders, from the administration to the public, including the business and scientific sectors. These recommendations reinforce the idea that protected areas, such as the Cabo de Gata-Níjar Natural Park, should adopt adaptive management models to anticipate and respond to the impacts of climate change in an effective and socially legitimized manner.

Likewise, within the framework of the present *Interreg Euromed NaTour4Change* project, the **Local Action Group (Taskforce)** of the Cabo de Gata-Níjar Natural Park has been formed, aimed at promoting a more inclusive and resilient governance in the face of climate change. This Taskforce was formally created at the meeting of February 13, 2025 at the park's administrative offices in Rodalquilar. It is composed of key representatives of the territory, including:

- Gloria García Hoyo (Technician of the Park's Interpretation Center - Tragsa SEPI).
- Salvador Parra Gómez (Director-Conservator of the Natural Park - Junta de Andalucía)
- Julián Vera (President of the Association of Friends of the Natural Park)
- M^a Dolores Villegas Carmona (President of ASEMPARNA, Association of Tourist Service Entrepreneurs of the Park).
- José Francisco Benítez Santos (Technical Advisor on European Projects - Department of Tourism)
- Natalia García Gareta (Tourism Technician - Department of Tourism)



4. CLIMATE DATA COLLECTION AND ANALYSIS

4.1. Description of data collection methods

The preparation of this report is based on a systematic approach to data collection that integrates various sources at local, regional, state and European scales. The objective has been to gather a solid and representative knowledge base to assess the impacts of climate change in the Cabo de Gata-Níjar Natural Park and its relationship with tourism. The information is organized below according to its origin and nature.

Institutional sources and strategic projects

- **II Sustainable Development Plan for the Cabo de Gata-Níjar Natural Park (2022):** Base document for the knowledge of the territorial, social, economic and environmental context of the park, including relevant sectoral analyses.
- **Andalusian Climate Action Plan (PAAC):** Strategic framework of the Regional Government of Andalusia for climate change mitigation and adaptation. It serves as a transversal reference for the integration of climate criteria in sectoral planning, including the management of protected natural areas.
- **Methodological guide for the assessment and monitoring of climate risks in the framework of the Andalusian Climate Action Plan (2023):** Technical document prepared by the Junta de Andalucía (November 2023), which provides practical tools to identify, assess and monitor climate risks at a territorial scale. Its application is key in the adaptive planning of the Natural Park.
- **LIFE ADAPTAMED Project:** European project focused on adaptation to climate change in three Andalusian protected areas (Doñana, Sierra Nevada and Cabo de Gata). Technical documentation has been used on:
 - Ecosystem services (soil, vegetation, landscape).
 - Benefits of the natural space.
 - Adaptive governance plans in Cabo de Gata.
 - Landscape-scale ecological monitoring protocols.
- **Reports of the Governing Board of the Natural Park:** Annual and specific reports that include proposals, agreements and monitoring of actions related to conservation and environmental management.

2. Scientific studies and technical literature

- **Academic articles:** Specific bibliography focused on Cabo de Gata and climate change has been consulted, such as the work of Alfonso Rafael Viciano Martínez-Lage and other publications collected in document bases and archives.



- **Previous projects and studies:** Compilation of previous works of interest compiled in the document "4_Projects and publications", such as:
 - Andalusian climate strategy for adaptation to climate change.
 - Andalusian Climate Action Plan (PAAC 2021-2030).
 - EU strategy on adaptation to climate change (2050).

3. Modeling tools and climate scenarios

- **IPCC - Climate Change Scenarios:** The methodological frameworks and emissions scenarios defined by the IPCC, especially the SRES, AR5 and AR6 reports, have been used for future climate projections.
- **SICMA (Information System on Climate Change in Andalusia):** Official viewer developed by the Foundation for Climate Research and Meteogrid, which allows consulting localized data from regionalized models.
- **REDIAM - Environmental Information Network of Andalusia:** Platform of the Regional Government of Andalusia that offers historical climate data and analysis tools from its observation networks.

4. Specific studies and analyses on the coast and climate risk.

- **Ministry of Ecological Transition (MITECO):**
 - *Report Climate Change on the Spanish Coast (2014).*
 - *Preliminary analysis of the vulnerability of the Andalusian coast to sea level rise (2012).*
 - *Strategies for coastal protection in Cadiz, Malaga and Almeria.*
 - *Climate change adaptation strategy for the Spanish coast (2016).*
- **Thematic publications:** Technical and scientific reference works related to the effects of climate change on natural systems, the adaptation of protected areas, and the assessment of ecological and territorial vulnerabilities have been incorporated. These publications provide methodological approaches and useful evidence to contextualize the situation of the Cabo de Gata-Níjar Natural Park in the context of climate change.

5. Local observations and municipal documentation

- **Climate diagnosis of Níjar and Carboneras:** Section "1.3.3 Data and methods" details the indicators used for the local climate analysis and the construction of future scenarios. The variables analyzed are:
 - Average annual temperature.
 - Maximum annual temperature.
 - Minimum annual temperature.
 - Annual precipitation.
 - Reference evapotranspiration.
 - Number of hot days (40 °C).

- Number of tropical nights (22 °C).
- Historical records (1985-2014) and projections extracted from the local climate scenario visualization application (SICMA) offered by the Junta de Andalucía and developed by the Foundation for Climate Research and Meteogrid are used.
- **Almeria Municipal Climate Change Plan (2024):** Although in the process of approval, this plan has been considered as a complementary reference for the assessment of climate risks and impacts at the county scale, especially in terms of territorial planning, urban adaptation and water resource management.
- **Mobility Management Plan in the Habitats of Community Interest of the Natural Areas of Punta Entinas-Sabinar and Cabo de Gata-Níjar (2014):** Prepared by the Environment and Water Agency, this plan provides guidelines and proposals for a more sustainable and regulated mobility model in natural spaces with high tourist pressure, including specific actions in the area of the Cabo de Gata-Níjar Natural Park.

6. Other complementary sources

- **Media and local dissemination:** A complementary search was conducted for news, reports and initiatives reflected in the regional press on social perception of climate change, land use conflicts, tourism pressure and citizen actions.
- **Technical and regulatory records:** Current regulatory frameworks and public strategies applicable to the area of action have been reviewed.

4.2. State of the art in climate action planning and assessment

The growing scientific evidence on the impacts of climate change has driven the need to develop and implement climate planning strategies at multiple scales, from international to local. In protected natural areas, such as the Cabo de Gata-Níjar Natural Park, this need is even more urgent due to the high vulnerability of their ecosystems and the strategic value of the ecosystem services they provide.

- **International and national frameworks**

At the global level, the **Paris Agreement** sets the framework for climate action, urging countries to formulate long-term strategies aimed at decarbonization and resilience. At the European level, the **European Green Pact** and the **EU Climate Change Adaptation Strategy** provide a roadmap for moving towards a sustainable economy, integrating the protection of biodiversity and ecosystems as key axes.

In Spain, **Law 7/2021 on climate change and energy transition** and the **National Plan for Adaptation to Climate Change (PNACC)** define objectives and priority lines of action, with emphasis on the integration of adaptation in sensitive sectors, including the management of natural areas.

- **Methodological approaches and tools**



Climate adaptation planning in protected areas requires a systematic approach that includes key phases such as:

- Vulnerability assessment of ecosystems and socioecosystems.
- Identification and prioritization of adaptation measures.
- Implementation.
- Continuous monitoring and evaluation.

In this process, platforms such as **Adaptateca** have established themselves as reference repositories, offering methodological guides, case studies, assessment tools and technical resources aimed at adaptation in key sectors, including biodiversity.

An important resource in this field is **EUROPARC-Spain's Manual 13**, entitled "*Protected areas in the context of global change*". This manual proposes a practical methodological framework for integrating climate adaptation into the daily planning and management of protected areas, from the analysis of impacts to the participatory design of strategies.

- **The Andalusian framework: applied strategies and instruments**

In the Andalusian context, the **Andalusian Strategy for Sustainable Development 2030 (EADS 2030)**, consistent with the 2030 Agenda, acts as a general framework. Specifically, climate action in protected areas is implemented through the **Sustainable Development Plans (PDS)** and the **Guiding Plans for Use and Management (PRUG)**.

The **II Sustainable Development Plan for Cabo de Gata-Níjar Natural Park (Decree 101/2022)** expressly recognizes climate change as a key threat to the landscape, and stresses the need to integrate environmental sustainability and climate adaptation criteria into the park's management.

In addition, there is a **methodological guide for the evaluation and monitoring of climate risks** (Junta de Andalucía, November 2023), which provides a systematic approach for assessing impacts and defining measures from a territorial and sectoral perspective.

- **Climate planning at the municipal level**

Within the framework of local capacity building, a series of key documents have recently been prepared to assess climate risks and plan action from the Park's own municipalities:

- **Report on the technical bases for the preparation and/or updating of the Municipal Plan against Climate Change in Níjar** (Department of Sustainability, Environment and Blue Economy, January 2025).
- **Technical basis report for the preparation and/or updating of the Municipal Plan against Climate Change in Carboneras** (Department of Sustainability, Environment and Blue Economy, January 2025).
- **Municipal Plan against Climate Change in Almería** (Department of Sustainability, Environment and Blue Economy, December 2024, version pending approval).

These documents provide vulnerability analyses, identification of local risks, climate scenarios and proposals for specific measures, and are key references for aligning municipal policies with the adaptive management of the Natural Park.

- **Climate action assessment**

Evaluation is a critical phase of the planning cycle. It involves monitoring implementation indicators and assessing their effectiveness in reducing vulnerability and increasing resilience. This evaluation should be continuous, flexible and allow for adaptive learning, adjusting measures as new information becomes available.

It is recommended to rely on integrated indicator systems (biophysical, socioeconomic and institutional), definition of baselines and long-term monitoring to attribute changes to the interventions carried out or to climate evolution.

- **Relevant initiatives and local knowledge**

Projects such as **LIFE ADAPTAMED** have contributed directly to applied knowledge on adaptation in Andalusian protected areas, including Cabo de Gata, not only through awareness-raising tools such as interpretive trails, but also through the definition of adaptive governance recommendations, monitoring protocols and ecosystem management proposals.

Even informative content and press articles, such as those published in *La Razón* (2022) on the loss of posidonia meadows or *Diario de Almería* (2021) on coastal retreat, although not technical, reflect the social perception and urgency that exists around climate impacts on the Natural Park.

4.3. Limitations of data sources

Despite the effort to integrate multiple sources of information for the analysis of the impacts of climate change on tourism in the Cabo de Gata-Níjar Natural Park, the process of data collection and analysis has several limitations that must be taken into account. These limitations are especially relevant in local contexts where environmental, socioeconomic and territorial data with different levels of availability and updating converge.

4.3.1. Gaps and limitations in available data

1. Limited spatial coverage

Although platforms such as REDIAM provide a wide network of climate stations in Andalusia, there are areas within the scope of the park - especially rural areas or areas of difficult access- with low observation density. This generates spatial gaps that reduce representativeness and make local-scale climate analyses difficult.

2. Time discontinuity and lack of homogeneous series



In some cases, the historical climate series do not present sufficient continuity, which complicates the construction of solid long-term trends. In addition, the consistency between paleoclimatic, historical and instrumental data is not always guaranteed, affecting the reliability of future scenarios in specific contexts such as Cabo de Gata-Níjar.

3. Fragmentation and heterogeneity of sources

The information used comes from projects, reports, scientific articles and observatories with different levels of updating, formats and scales. The integration of these sources presents methodological difficulties, especially when trying to harmonize climatic, ecological and tourism data in a single analytical structure.

4. Shortage of specific indicators on tourism and climate change

There are significant gaps in the availability of data on tourism economic variables linked to climate change, such as spending patterns, seasonal fluctuations or adaptation costs. Likewise, information on visitor behavior, perceptions of climate risk or willingness to modify habits is still limited and scattered.

4.3.2. Thematic gaps and technical challenges

1. Limited tourism and behavioral data

Despite the growing literature on tourism and climate change, the empirical information available at the local level is still partial with respect to variables such as tourism consumption patterns, seasonality, adaptation costs or visitor perceptions. This type of data would be key to refine specific adaptation strategies in the sector.

2. Mismatches between sources and methodologies

The diversity of methods used in the available studies (IPCC scenarios, regionalized databases, case studies) may make it difficult to harmonize them. Although this does not invalidate their usefulness, it does require the application of rigorous technical criteria when synthesizing or transferring the results to a territorial scale.

3. Resources and technical capabilities

The generation and updating of high-resolution climatic or socioeconomic data requires specific technical and human resources. In contexts such as Cabo de Gata-Níjar, the availability of these resources may vary, which conditions the possibility of carrying out systematic monitoring or complex modeling.

5. HISTORICAL CLIMATE ANALYSIS AND FUTURE PROJECTIONS

Understanding past climate evolution and future projections is essential for identifying impacts and planning adaptation measures in the tourism sector of the Cabo de Gata-Níjar Natural Park. This section presents an analysis of historical climate trends and future scenarios for the Park's environment, based on a robust methodology recognized by Andalusia's own climate change office.

5.1. Methodological Framework and Data Sources

The climate analysis presented below is based on a rigorous methodology, aligned with the most recent guidelines and models of the Intergovernmental Panel on Climate Change (IPCC). This methodological approach is the one currently used by the Department of Sustainability, Environment and Blue Economy of the Regional Government of Andalusia for the preparation of studies and action plans to address climate change at regional and local level. This methodological choice is not accidental, but responds to the need to ensure consistency with official analyses, facilitate the comparability of the results and allow the integration of the conclusions in the territorial and sectoral planning frameworks in force in the autonomous community.

For the analysis of historical trends and the generation of future climate projections, the tools and databases provided by the Junta de Andalucía have been used. Historically, the Environmental Information Network of Andalusia (REDIAM) has offered, through its "Application for downloading and visualization of regionalized climate scenarios for Andalusia", the necessary data for these studies. More recently, and adapted to the Sixth Assessment Report of the IPCC (AR6), the Junta de Andalucía, in collaboration with the Foundation for Climate Research and Meteogrid, has developed the viewer for consultation of local climate change scenarios in Andalusia (SICMA), accessible at andalucia.sicma.red. This viewer has become the main reference for the consultation of regionalized climate projections in Andalusia, offering data with a high spatial resolution that allows a detailed analysis adapted to the specific characteristics of the territory, including the Cabo de Gata-Níjar Natural Park.

The future climate scenarios are based on the Shared Socioeconomic Pathways (SSP) defined by the IPCC. For this analysis, two representative scenarios covering a plausible range of future socioeconomic developments and greenhouse gas (GHG) emission levels are mainly considered:

- **SSP2-4.5:** An intermediate or stabilization scenario, where climate policies are implemented that lead to a radiative forcing of 4.5 W/m² by 2100. This scenario assumes socioeconomic development that follows historical trends with some additional mitigation efforts.
- **SSP5-8.5:** A high GHG emissions scenario, characterized by socioeconomic development based on intensive use of fossil fuels,



resulting in a radiative forcing of 8.5 W/m^2 by the year 2100. This scenario represents the upper end of the range of future emissions.

The projections are analyzed for different time horizons: a near future (generally 2021-2040), a medium future (2041-2070 or similar) and a distant future (2071-2100), always compared to a historical reference period (commonly 1985-2014 or 1995-2014, depending on the specific source consulted in the base reports).

The adoption of this methodology and data sources, endorsed and used by the Andalusian environmental administration, gives this analysis the solidity and rigor necessary for informed decision-making on climate change adaptation in the Cabo de Gata-Níjar Natural Park.

5.2. Analysis of Historical Climate Trends in the Surroundings of Cabo de Gata-Níjar Natural Park (Reference period: 1985-2014).

The analysis of climate trends during the reference period 1985-2014 allows us to understand the recent evolution of the climate in the Cabo de Gata-Níjar Natural Park region. The data extracted from the technical studies of the municipalities of Níjar and Carboneras, both with a significant part of their territory within or in the direct influence of the Park, and based on the SICMA and REDIAM methodology, offer a detailed view of this evolution.



Average Annual Temperature



Image2 . Map of mean annual temperature (°C). Source: SICMA



Graph5 . Historical average temperature in Níjar. Source: SICMA

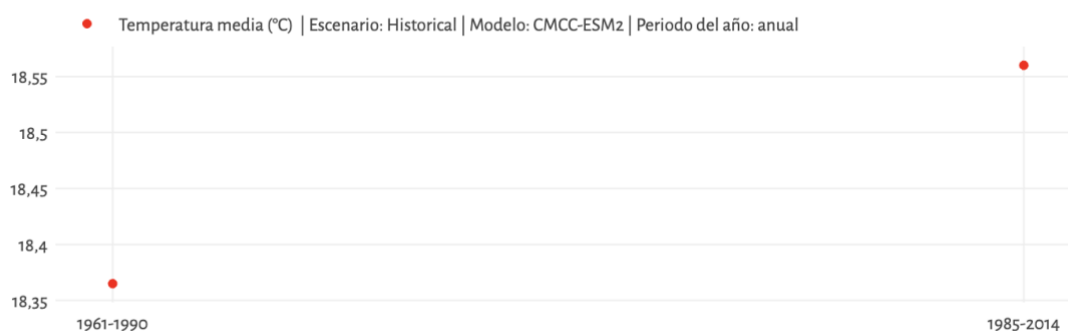


Carboneras (-1.9429, 36.9959) msnm: 87



Graph6 . Historical average temperature in Carboneras. Source: SICMA

Almería (-2.2668, 36.8914) msnm: 186



Graph 6. Historical average temperature in Almeria. Source: SICMA

During the historical period 1985-2014, the mean annual temperature in the Cabo de Gata-Níjar Natural Park environment has been consistently around 18.5 °C to 18.6 °C. There has been a clear upward trend in both absolute maximum and absolute minimum temperatures throughout this period. This behavior is a clear indication of the progressive and generalized increase in temperature in the region, which has led to a gradual increase in average annual temperatures.



Maximum Annual Temperature

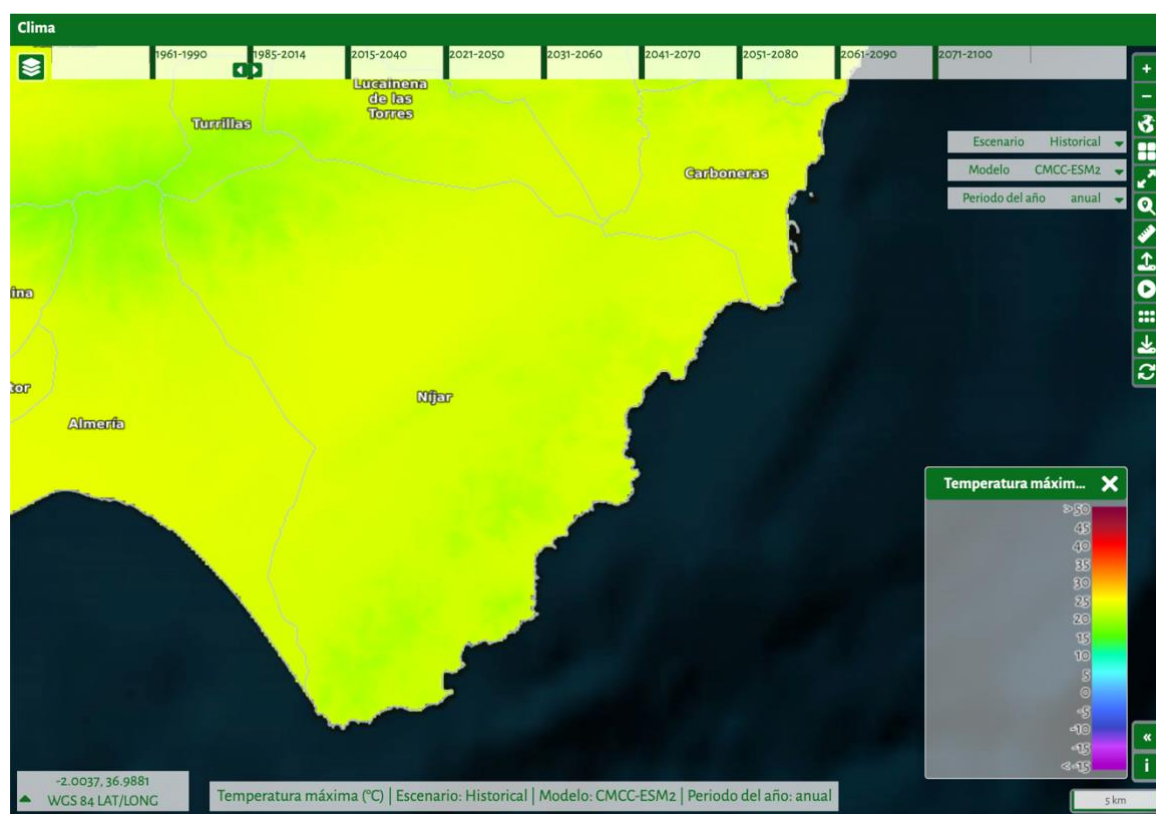
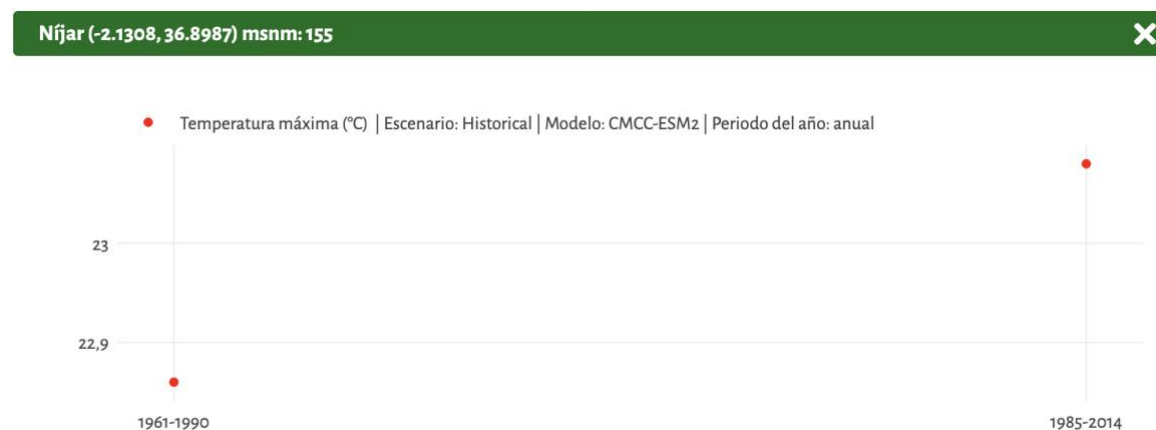


Image3. Annual maximum temperature map (°C). Source: SICMA



Graph7. Historical maximum temperature in Níjar. Source: SICMA

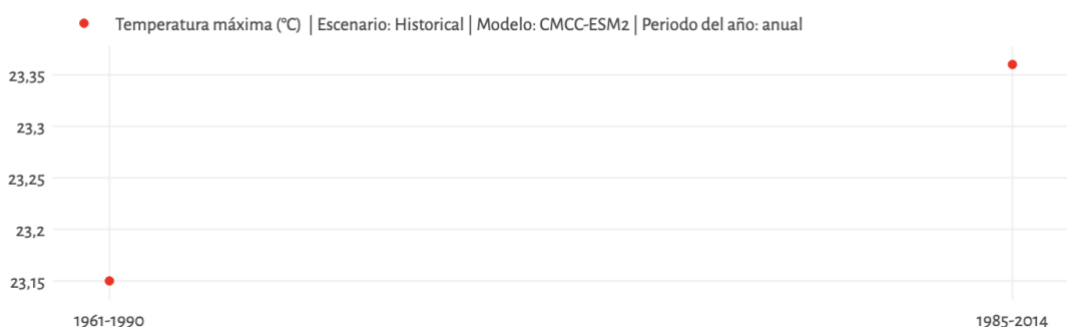


Carboneras (-1.9415, 37.0162) msnm: 177



Graph8 . Historical maximum temperature in Carboneras. Source: SICMA

Almería (-2.2533, 36.8622) msnm: 76



Graph9 . Historical maximum temperature in Almería. Source: SICMA

As for the maximum annual temperature, there is some local variability within the park's environment. While in more inland areas such as Níjar, the annual maximum temperature has been around 33 °C, in coastal areas such as Carboneras, this value is around 23.2 °C. However, in both areas, the trend in absolute maximum temperatures during the reference period has been consistently upward. This increase in maximum temperatures is a key factor in the intensification of hot days.

Annual Minimum Temperature



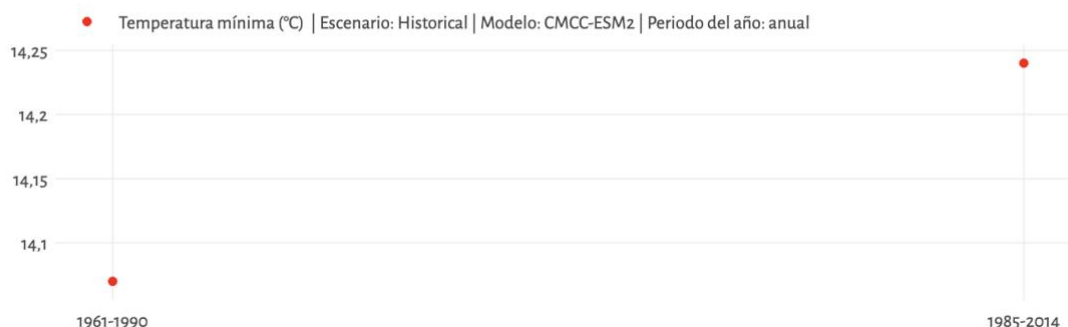
Image4 . Map of minimum annual temperature (°C). Source: SICMA



Graph10 . Historical minimum temperature in Níjar. Source: SICMA



Carboneras (-1.9517, 37.0095) msnm: 166

*Graph11 . Historical minimum temperature in Carboneras. Source: SICMA*

Almería (-2.2875, 36.8840) msnm: 144

*Graph12 . Historical minimum temperature in Almería. Source: SICMA*

The annual minimum temperature in the area surrounding the Natural Park, during the period 1985-2014, has been around 14 °C. As with average and maximum temperatures, there has been an upward trend in absolute minimum temperatures. This increase in minimum temperatures has direct consequences, such as the notable reduction in the number of frost days (days with minimum temperature ≤ 0 °C), which have become practically anecdotal in the area, with no frost days recorded at all over the course of a full year becoming more and more frequent.

Annual Precipitation

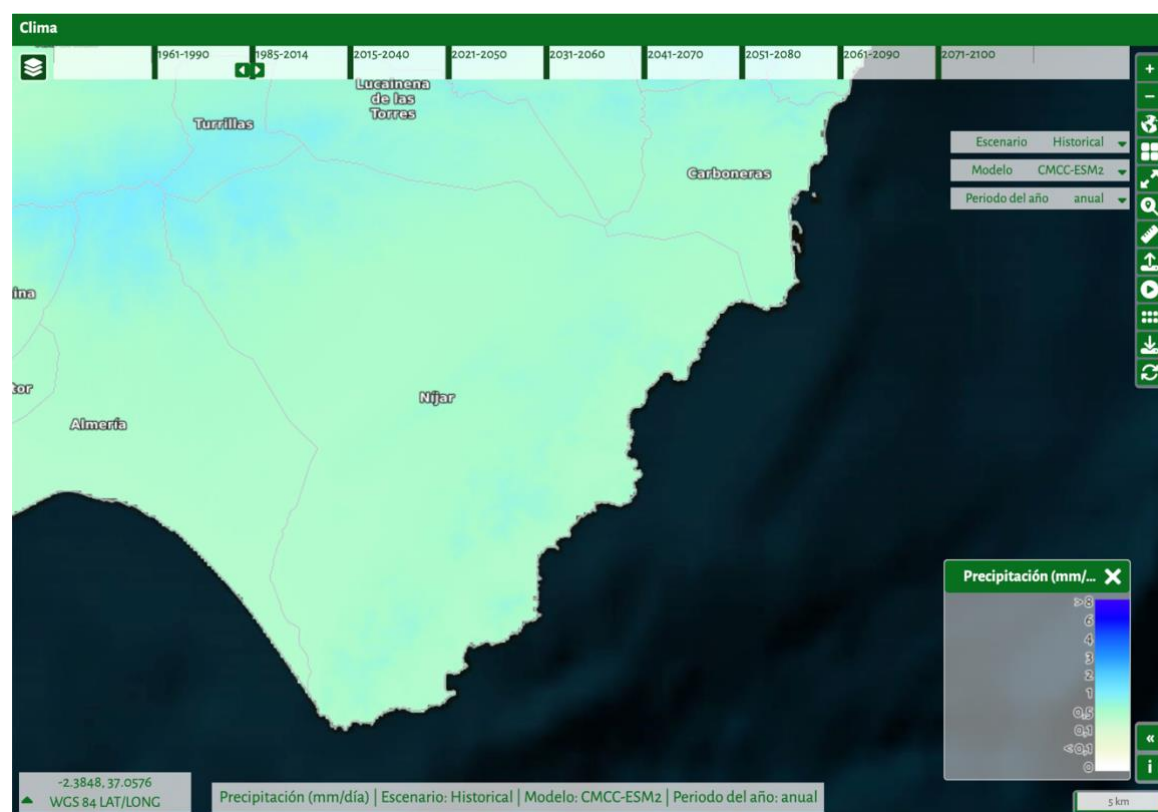
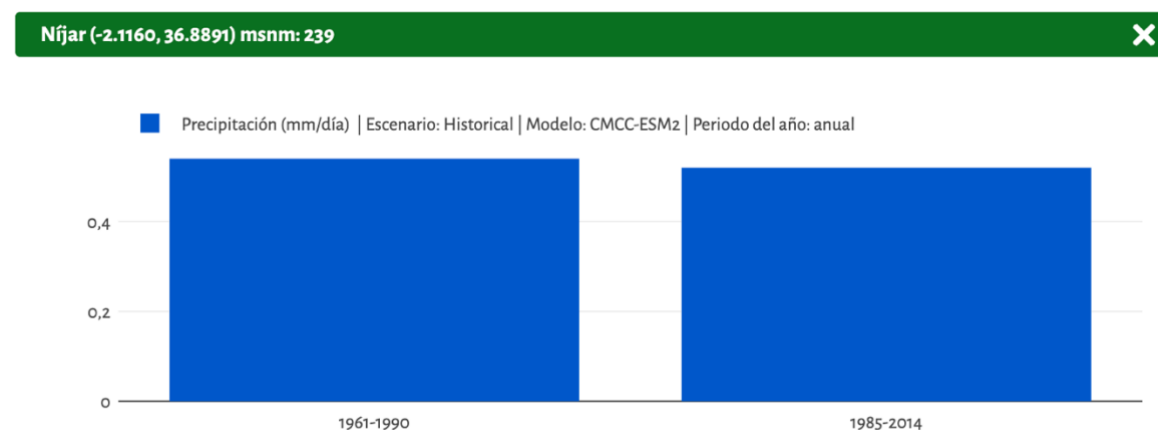
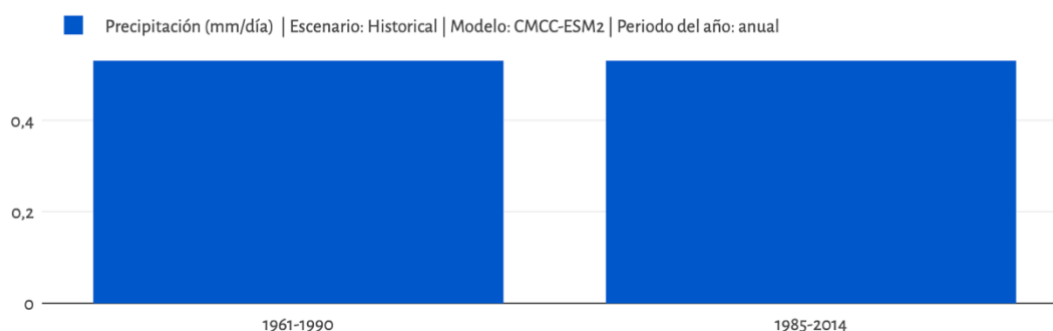


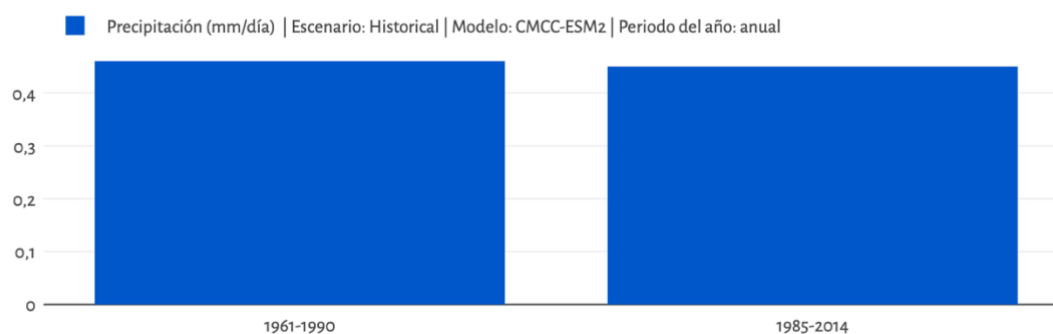
Image5. Map of mean annual precipitation (mm/day). Source: SICMA



Graph13. Mean annual historical precipitation (mm/day) in Níjar. Source: SICMA

**Carboneras (-1.9360, 36.9872) msnm: 126**

Graph14 . Average annual historical precipitation (mm/day) in Carboneras. Source: SICMA

Almería (-2.2751, 36.8720) msnm: 140

Graph15 . Average annual historical precipitation (mm/day) in Almería. Source: SICMA

Annual precipitation in the Cabo de Gata-Níjar Natural Park area is characteristically low and irregular. During the historical period 1985-2014, average annual precipitation has ranged from 200 mm in the Níjar area to 259 mm in the Carboneras area. Despite this variability, a general downward trend in precipitation volumes has been identified throughout the reference period. This decrease in rainfall has substantial implications for the availability of water resources. Rainfall tends to be concentrated mainly in autumn and winter, with a usual peak in the months of October and November, while summers are extremely dry.

Reference Evapotranspiration (ET_o)

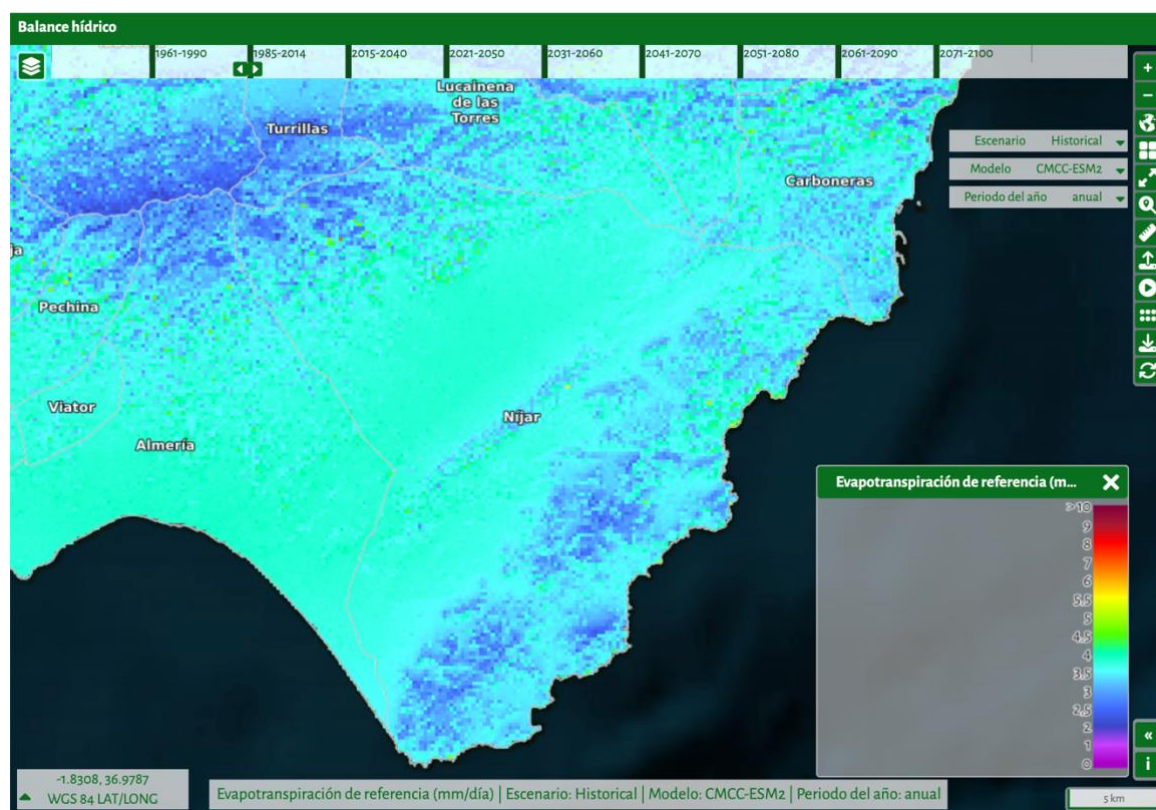
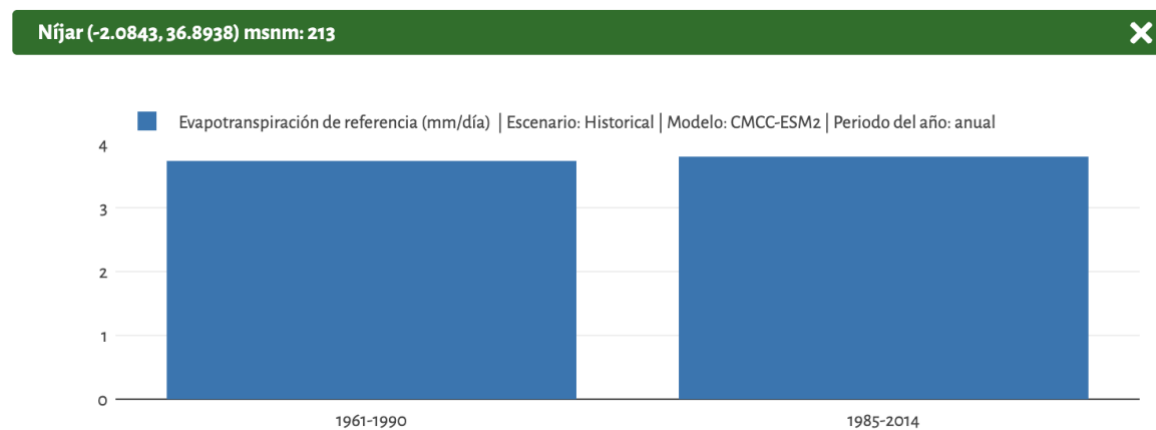


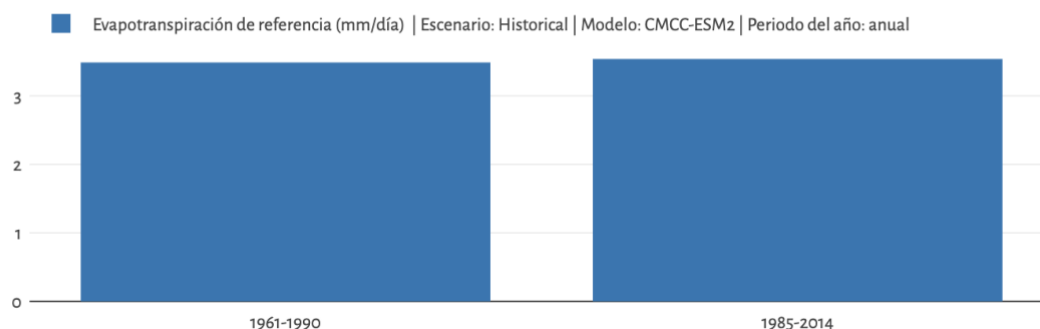
Image6 . Annual reference evapotranspiration map (mm/day). Source: SICMA



Graph16 . Annual reference evapotranspiration (mm/day) in Níjar. Source: SICMA

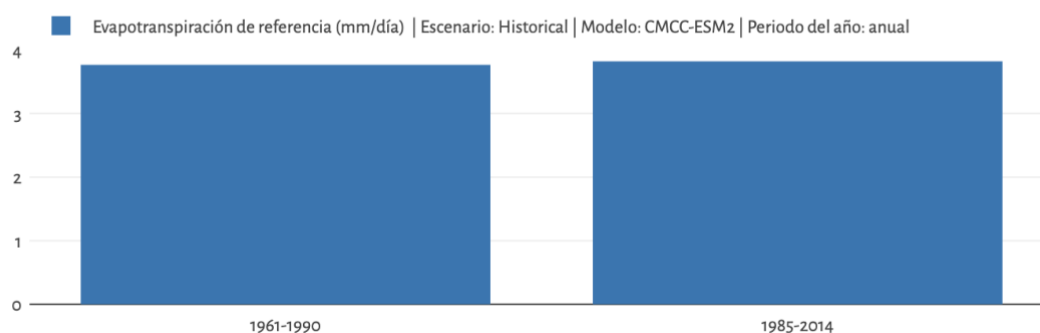


Carboneras (-1.9381, 36.9917) msnm: 127



Graph17 . Annual reference evapotranspiration (mm/day) in Carboneras. Source: SICMA

Almería (-2.2837, 36.8586) msnm: 68



Graph18 . Annual reference evapotranspiration (mm/day) in Almería. Source: SICMA

Reference evapotranspiration, which combines water loss by vegetation transpiration and direct evaporation from the soil, is a crucial indicator for water resource management, especially in an arid area such as Cabo de Gata. For the historical period 1985-2014, in the Carboneras environment, the annual ETo was around 1,239 mm, showing an increasing trend, which, combined with the decrease in precipitation, exacerbates the water deficit.

Number of Hot Days ($T_{max} \geq 40^{\circ}\text{C}$)

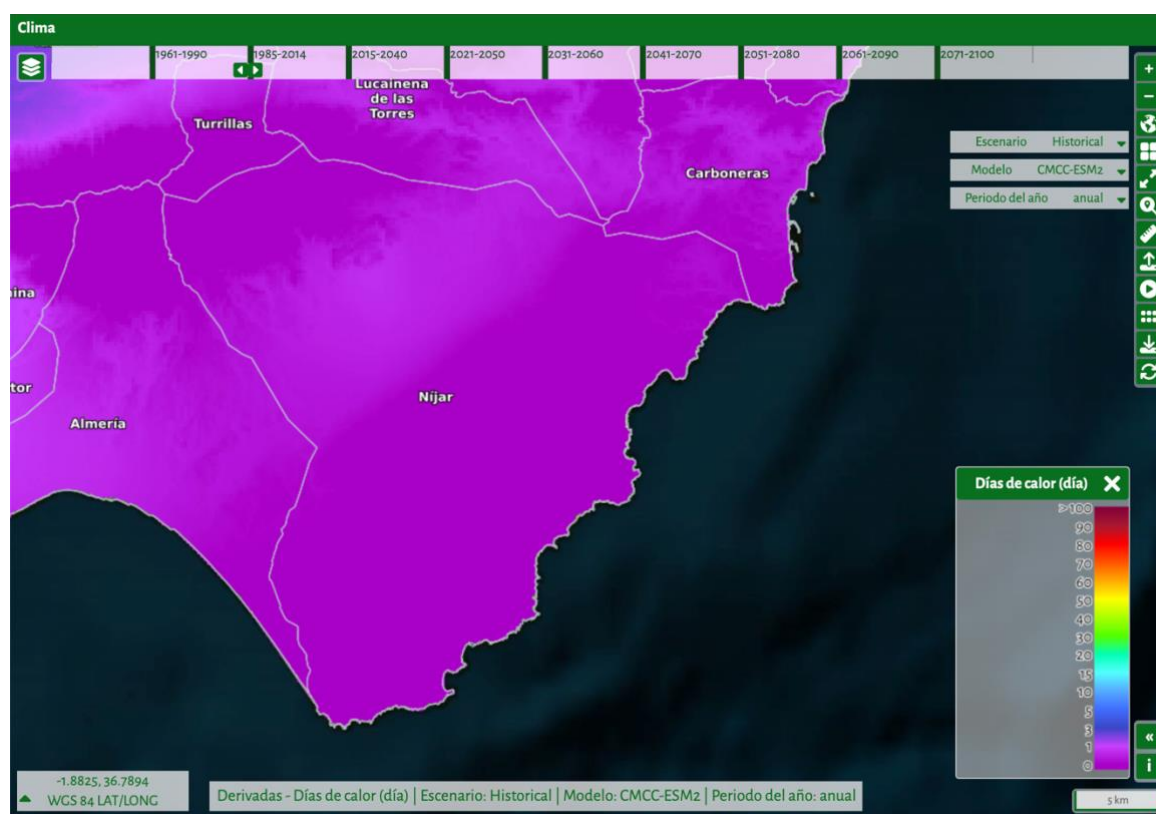
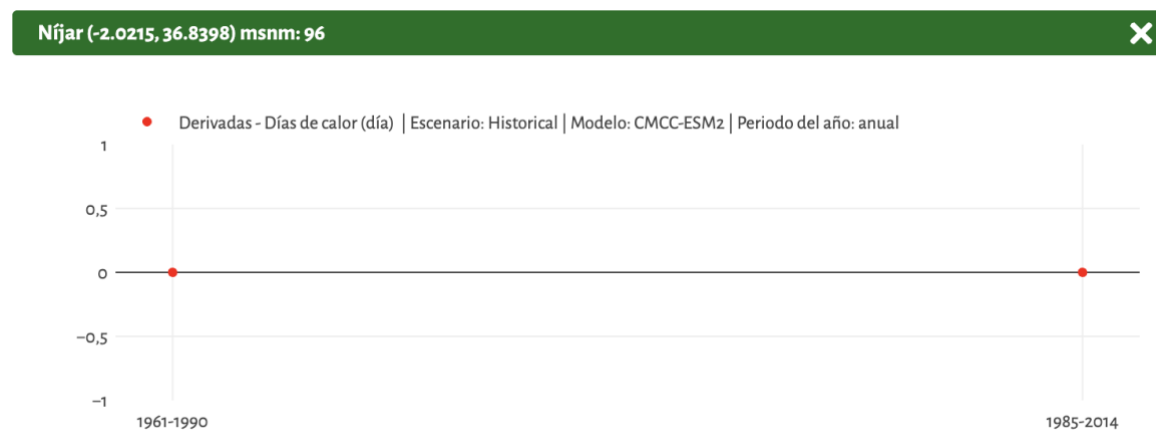


Image7. Map of number of hot days. Source: SICMA

Níjar coast

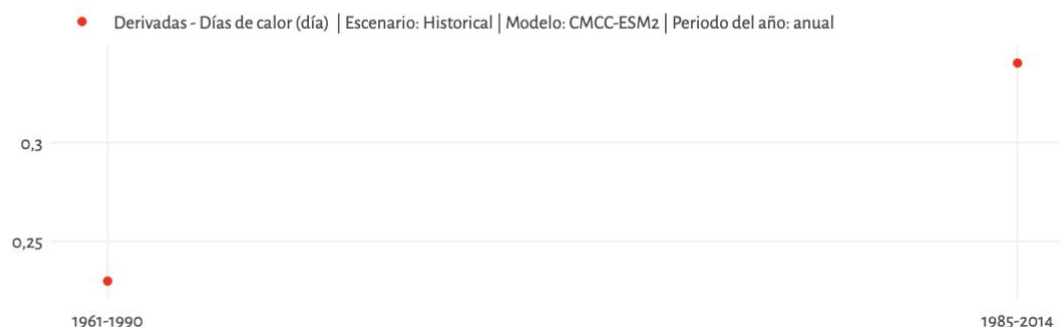


Graph19. Number of hot days on the coast of Níjar. Source: SICMA

Interior of níjar

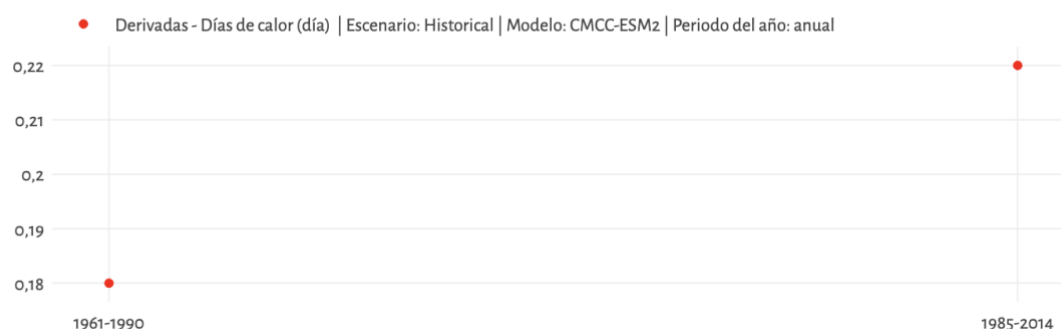


Níjar (-2.1321, 36.9142) msnm: 119



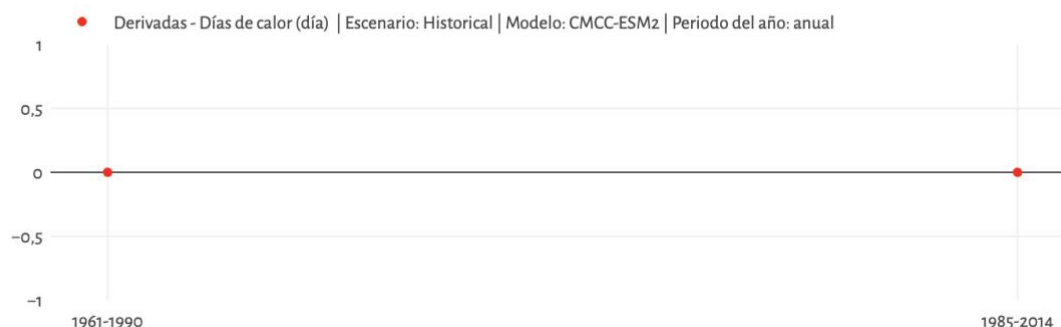
Graph20 . Number of hot days in the interior of Níjar. Source: SICMA

Carboneras (-1.9045, 36.9882) msnm: 4



Graph21 . Number of hot days on the coast of Carboneras. Source: SICMA

Almería (-2.2238, 36.7641) msnm: 2



Graph22 . Number of hot days on the coast of Almería. Source: SICMA

Extreme heat days, defined as those when the maximum temperature reaches or exceeds 40 °C, have been historically infrequent in the direct coastal areas of the Park, where the number of such days was practically nil in the period 1985-2014. However, the upward trend in maximum temperatures suggests an increasing risk of occurrence and intensification of these events in the future, especially in the more inland areas of the Park.



Number of Tropical Nights ($T_{min} \geq 20^{\circ}\text{C}$ or $\geq 22^{\circ}\text{C}$):

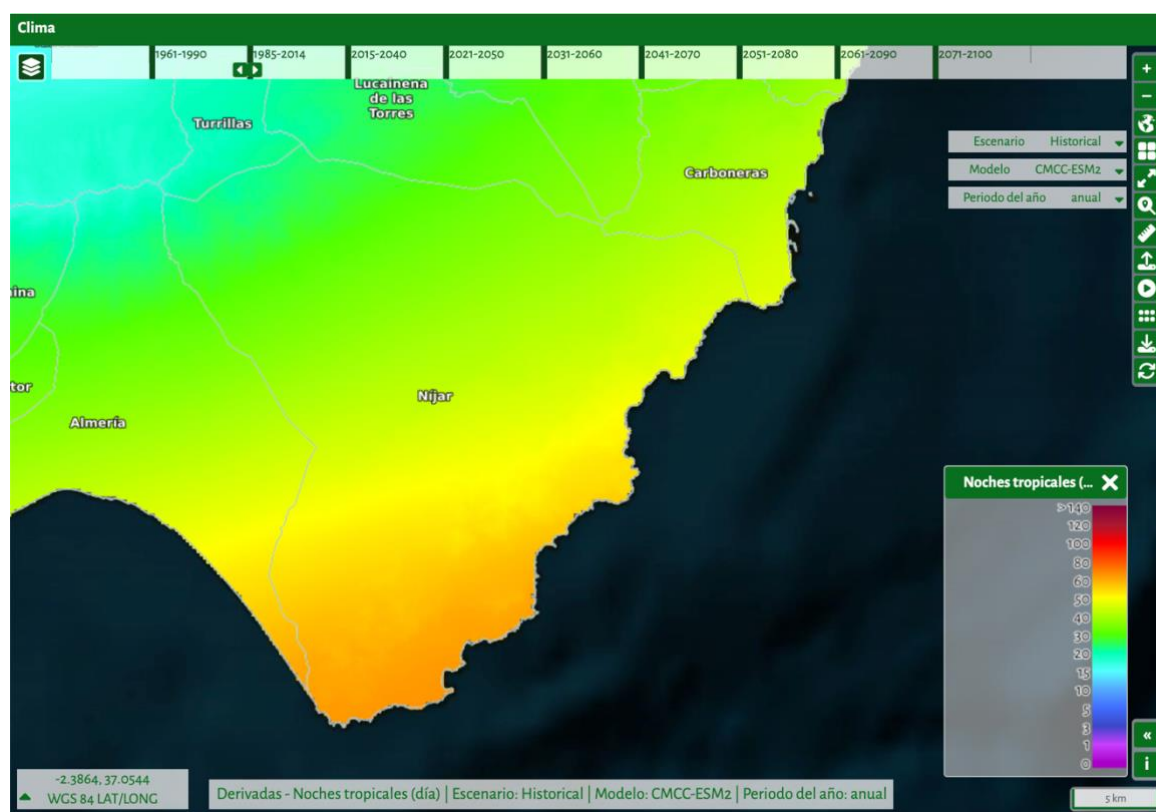
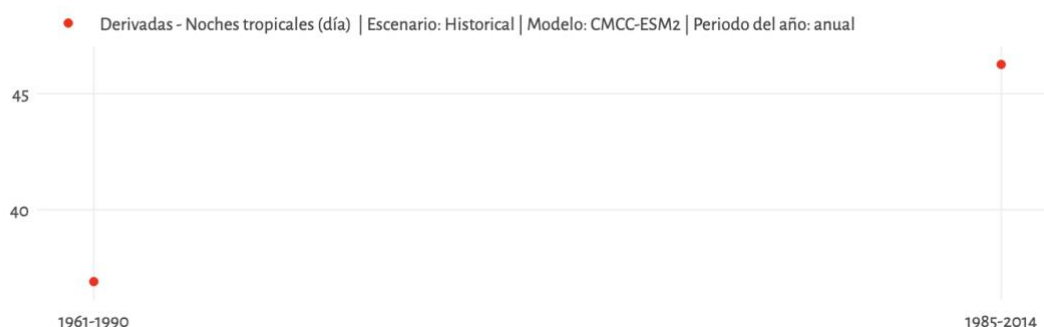


Image8 . Map of number of tropical nights. Source: SICMA



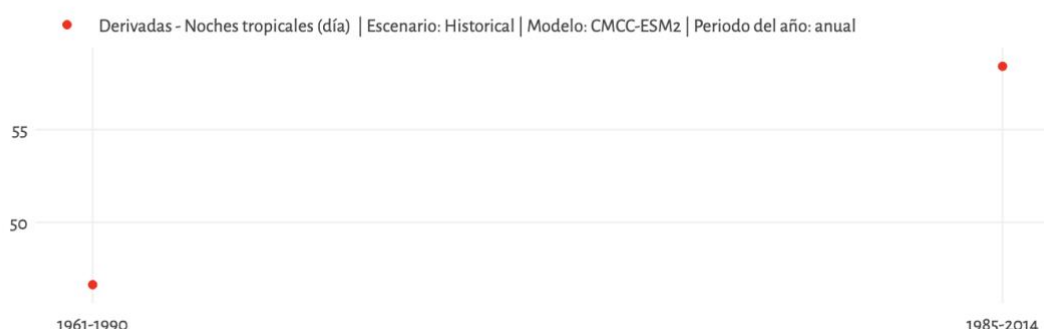
Graph23 . Number of tropical nights in Níjar. Source: SICMA

Carboneras (-1.9033, 36.9475) msnm: 110



Graph24 . Number of tropical nights in Carboneras. Source: SICMA

Almería (-2.2264, 36.7609)



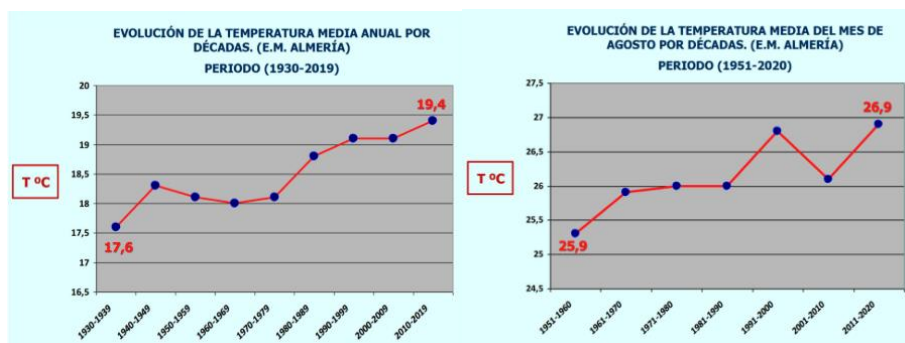
Graph25 . Number of tropical nights in Almeria. Source: SICMA

Tropical nights, characterized by minimum temperatures that do not fall below a certain threshold (20 °C or 22 °C, according to the definition used in the baseline reports), have shown a significant presence in the historical period. On the southern coast of Níjar, about 64 tropical nights ($T_{min} \geq 22$ °C) were recorded on an annual average during 1985-2014. The upward trend in minimum temperatures suggests an increase in the frequency and duration of these nights, which has implications for human comfort and cooling energy consumption.

5.3. Analysis of past extreme weather events.

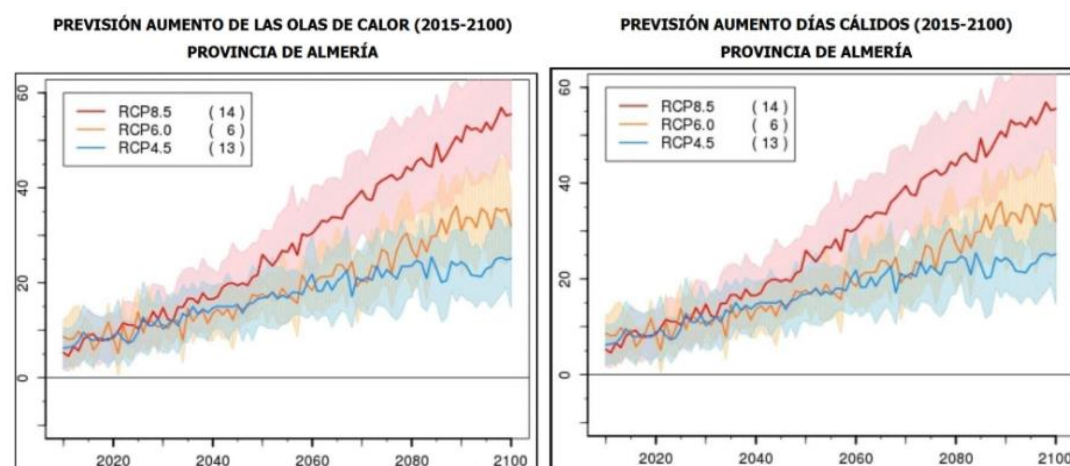
The Cabo de Gata-Níjar Natural Park is one of the most arid and fragile ecosystems in Europe. Its ecological uniqueness makes it especially sensitive to the effects of climate change, which have intensified in recent decades. Since its declaration as a protected area in 1988, there has been an increase in the frequency and severity of extreme climatic phenomena that threaten both biodiversity and the physical structure of the park.

One of the most notorious phenomena is the sustained increase in temperatures. Since the pre-industrial era, Spain has recorded an average increase of 1.7 °C, higher than the global average of 1.2 °C. This increase has led to an intensification of heat waves in the Cabo de Gata-Níjar region.



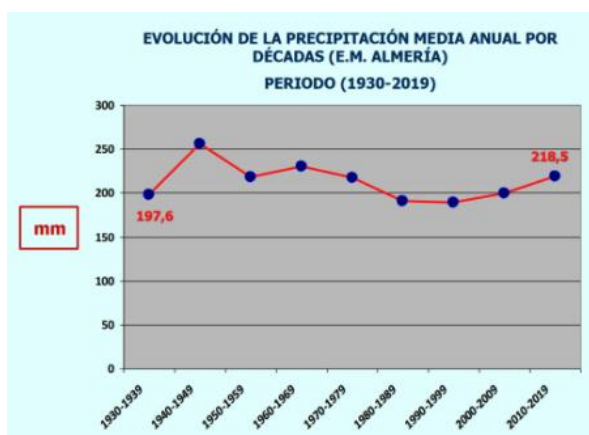
Graph26 . Evolution of mean annual temperatures in Almería, Spain: Alfonso Rafael Viciano Martinez-Lage based on AEMET data.

It is estimated that between 2050 and 2095, the intensity of these waves could increase by up to 144% with respect to the 1971-2000 reference period, with a territorial expansion of up to 2.7% per decade, depending on the volume of greenhouse gas emissions (Viciano Martinez-Lage, 2022; Cadena SER, 2025).



Graph27 . Forecast increase in heat waves and hot days in the province of Almería. Source:AEMET, 2018

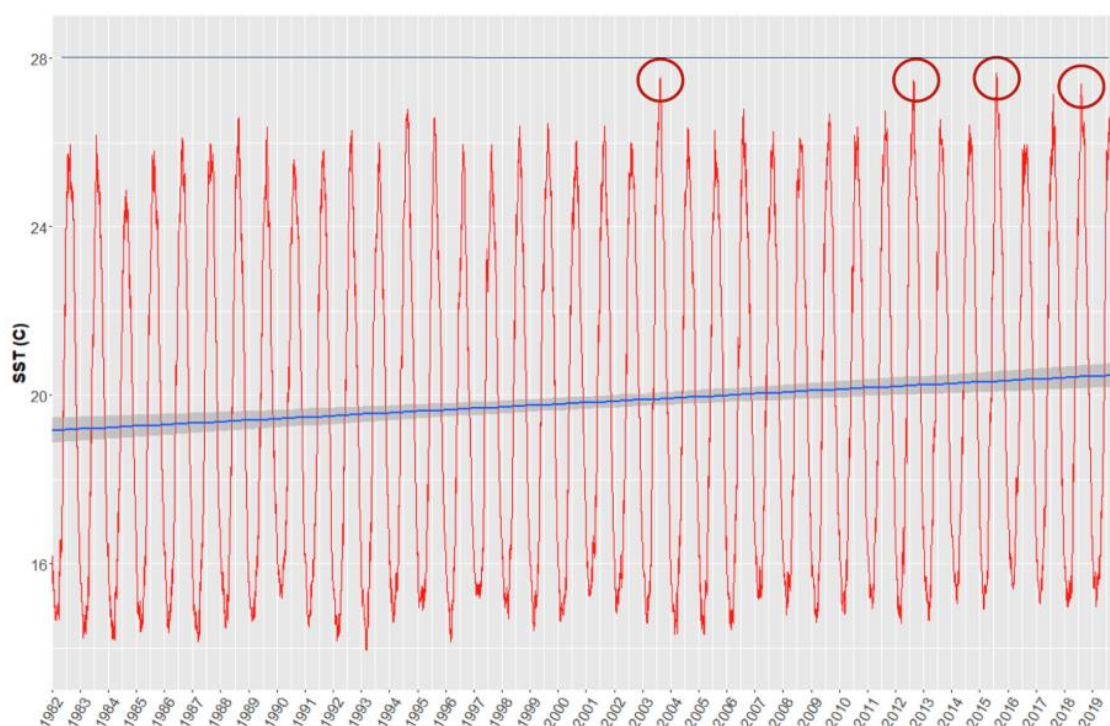
Along with high temperatures, water scarcity is another major challenge.



Graph28 . Evolution of mean annual precipitation by decades in Almería. Source: Alfonso Rafael Viciano Martinez-Lage based on AEMET data.

The park has an extremely low average annual rainfall, which varies between 183 mm and 271 mm, with historic lows of only 37 mm in one year. This low rainfall, coupled with water demand and overexploitation of aquifers, has led to groundwater salinization, especially affecting the park's phreatophyte species and its delicate ecological balance (Viciana Martínez-Lage, 2021).

Although it is an arid area, the Cabo de Gata-Níjar Natural Park is not exempt from extreme meteorological phenomena. According to Dr. Alfonso Rafael Viciana Martínez-Lage, the increase in the temperature of the Mediterranean Sea is strengthening the Mediterranean cyclogenesis, which increases the power and recurrence of Isolated Depressions at High Levels (DANAs) in the region.



ASCENSO TEMPERATURA SUPERFICIAL EN EL MAR MEDITERRÁNEO ESPAÑOL

(1982-2019)

(MEDIAS ANUALES, MÍNIMAS Y MÁXIMAS)

eco21-20d

Graph29. Rise in surface temperature in the Spanish Mediterranean Sea. Source: Center for Environmental Studies of the Mediterranean, 2018.

These DANAs can cause very intense torrential rains in short periods of time, generating severe erosive processes, soil degradation and alterations in the fluvial dynamics of wadis and natural watercourses, creating an increasingly unstable landscape. Dr. Viciana points out that the clearest evidence is that the increase in sea temperature will strengthen the so-called Mediterranean cyclogenesis and increase the power and recurrence in time of NAD episodes (Viciana Martínez-Lage, 2021).

These extreme events have had significant impacts on the region. For example, in September 2019, a DANA triggered torrential rains that caused flooding in

several areas of southeastern Spain, including the Cabo de Gata-Níjar Natural Park. The consequences included damage to infrastructure, loss of fertile soils, and impacts on local biodiversity.

The image below shows the effects of a DANA on the Cabo de Gata campsite and the park's coastline, showing the flooding caused by heavy rains:



Image9 . Cabo de Gata campsite flooded as a result of heavy rains. Source: Rafael González (EUROPA PRESS)



Foto: Después de la DANA de septiembre 2019 en San José © PGC



Foto: Después de la DANA de septiembre 2019 en San José © PGC

Image10 . Effects of the 2019 DANA on the PN coastline. Source: Alfonso Rafael Viciano Martinez-Lage, Amigos del parque natural cabo de gata.

These phenomena highlight the need to implement adaptation and mitigation measures to preserve the ecosystems and infrastructures of the Cabo de Gata-Níjar Natural Park from the effects of climate change.

These phenomena, as a whole, are having a considerable impact on the park's biodiversity. The combination of heat waves, prolonged droughts, and torrential rainfall is causing changes in the phenology, distribution, and viability of numerous species. Some endemic species adapted to the park's extreme conditions are now threatened by alterations that exceed their capacity to adapt in the short term (La Razón, 2022).

In conclusion, the Cabo de Gata-Níjar Natural Park is in a situation of increasing vulnerability to extreme weather events resulting from climate change. It is essential to adopt comprehensive adaptation and conservation measures, including sustainable water management, restoration of coastal ecosystems and active protection of biodiversity, to ensure the resilience of the Natural Park.

5.4. Future Climate Projections for Cabo de Gata-Níjar Natural Park

Future climate projections for the Cabo de Gata-Níjar Natural Park, based on the IPCC scenarios SSP2-4.5 (intermediate) and SSP5-8.5 (high emissions), indicate a continuation and accentuation of the trends observed in the historical period. Below is an analysis of the projections for the main climate indicators at different time horizons (near: 2021-2040; medium: 2041-2070; far: 2071-2100), referring to the historical period 1985-2014 or similar according to the base reports.

Mean Annual Temperature

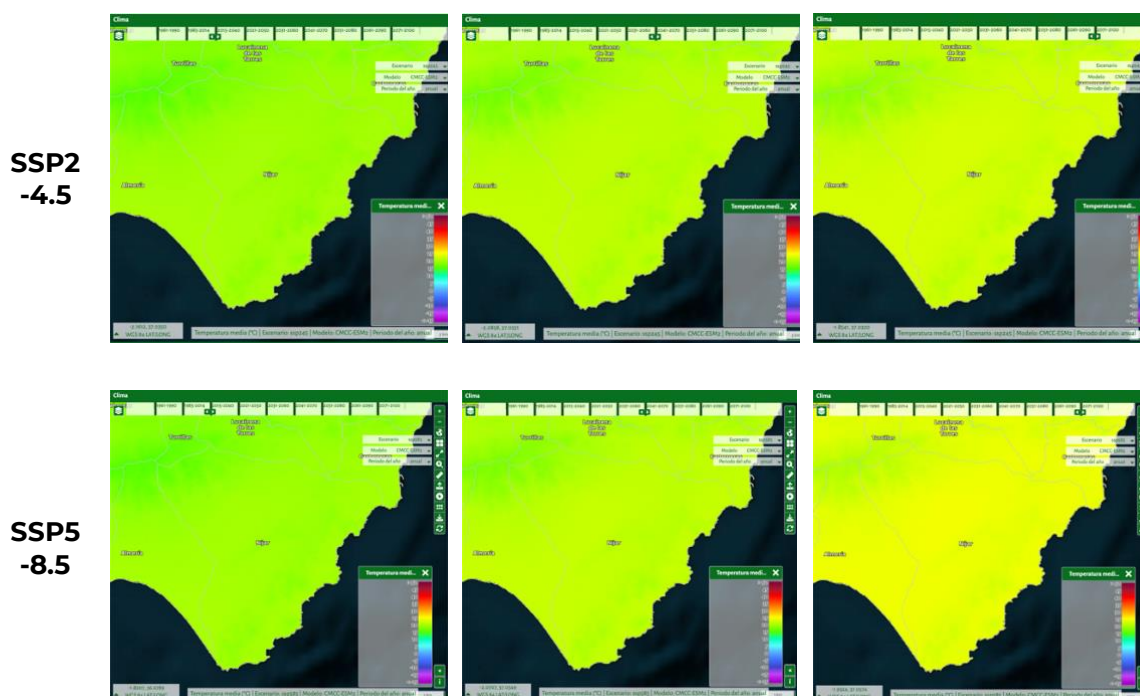


Image11. Climate scenarios for annual mean temperature (°C). Source: SICMA

A significant increase in mean annual temperature is projected for the Cabo de Gata-Níjar Natural Park under all scenarios and time horizons. Under the SSP2-4.5 scenario, the increase could be 18.37°C to 21.28°C for the far horizon (2071-

2100) with respect to the historical period. Under the more pessimistic SSP5-8.5 scenario, this increase would be considerably higher, reaching values of 18.37 to 23.90°C over the same horizon. These increases will be manifested in all seasons of the year, although with greater intensity during the summer.

Annual Maximum Temperature

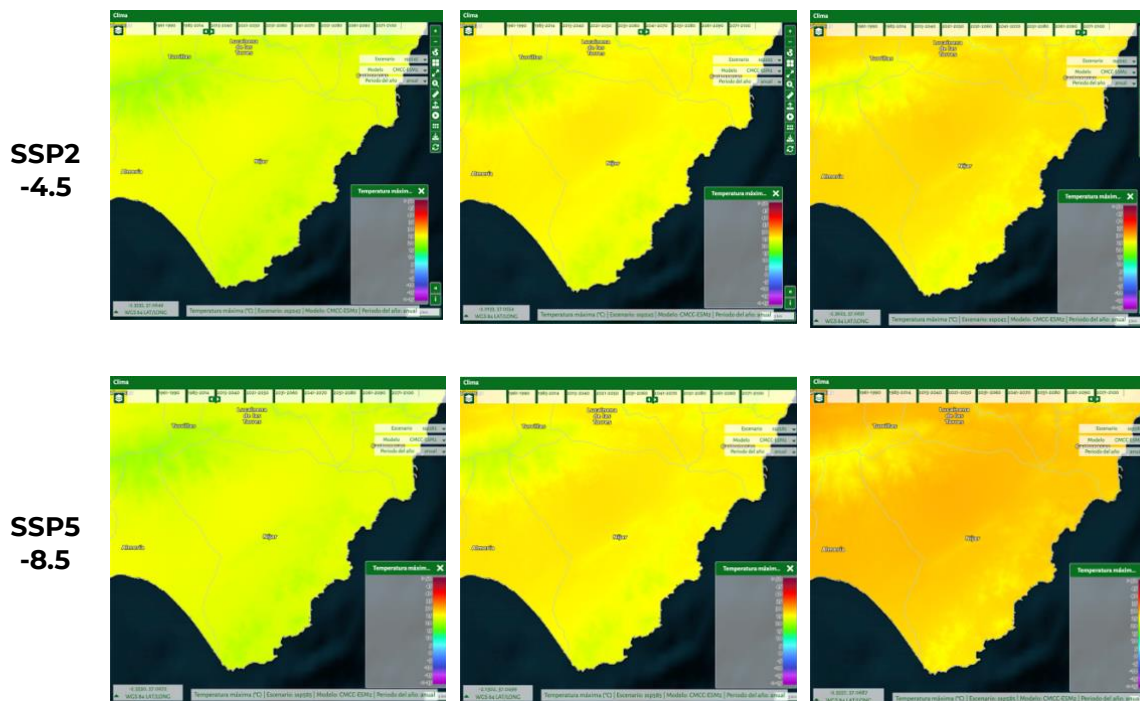
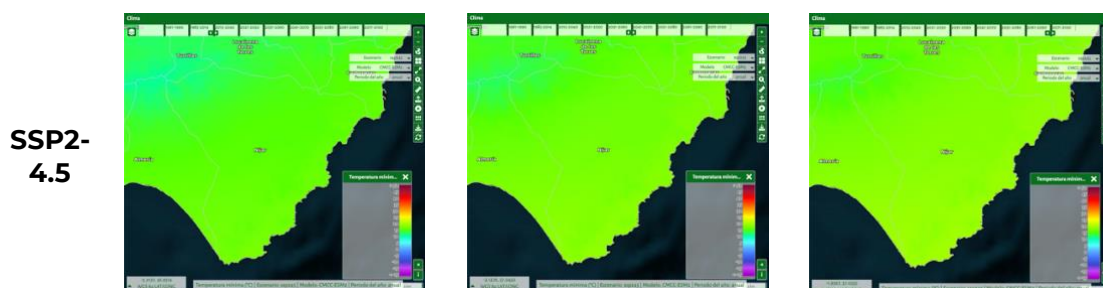


Image12. Climate scenarios for annual maximum temperature (°C). Source: SICMA

Annual maximum temperatures will also experience a notable increase. An increase in the frequency and intensity of heat waves is expected. For the distant horizon, under the SSP5-8.5 scenario, the increase in average maximum temperature could be 22.65 to 27.34°C for example along the Nijar coast. This will imply a greater exposure to thermal stress conditions for both ecosystems and the population and visitors.

Minimum Annual Temperature



SSP5-8.5

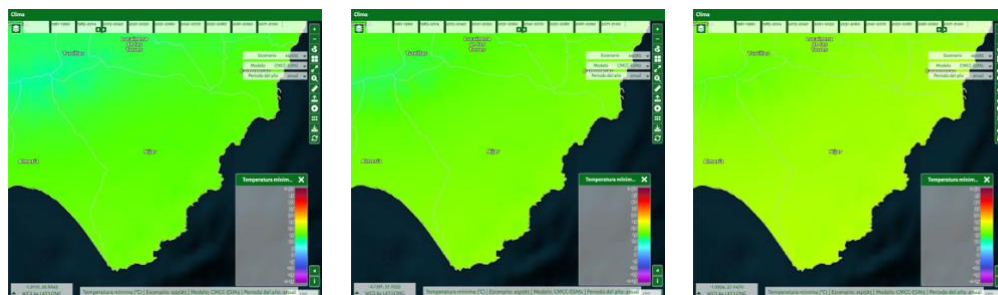


Image13. Climate scenarios for minimum annual temperature (°C). Source: SICMA

Both scenarios show how minimum temperatures will follow the same upward trend up to maximums of approximately 20.65°C minimum temperature, which will result in milder winters and a practical disappearance of frost days. The increase in minimum nighttime temperatures during the summer will consequently be especially pronounced.

Annual Precipitation

SSP2-4.5



SSP5-8.5



Image14. Climate scenarios for annual precipitation (mm/day). Source: SICMA

Precipitation projections for the Mediterranean region, and in particular for the arid southeast of the Iberian Peninsula, point to a generalized decrease in mean annual precipitation. For the Cabo de Gata-Níjar Natural Park, a reduction is expected that could go from 0.48 mm/day in the historical period to 0.38 mm/day for the far horizon under the SSP2-4.5 scenario, and be even more pronounced at 0.31 mm/day under the SSP5-8.5 scenario. In addition to the reduction in total amount, an increase in rainfall irregularity is predicted, with longer and more intense dry periods, and a possible increase in the torrentiality of rainfall events when they occur.

Reference Evapotranspiration (ET₀)

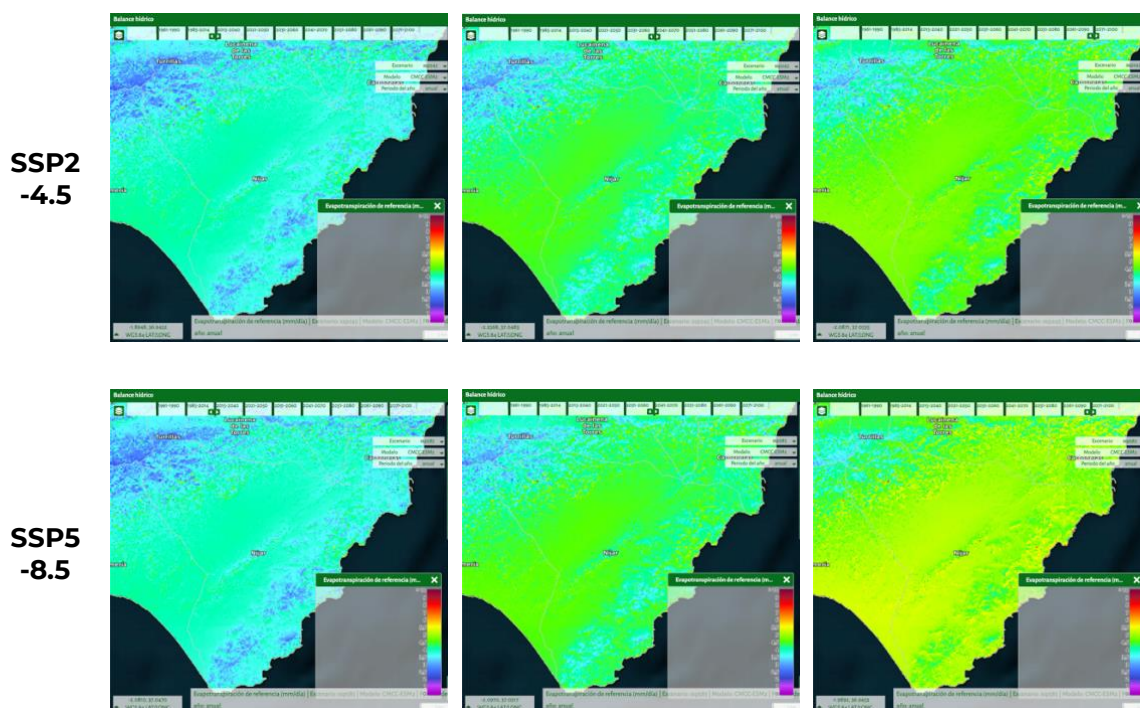
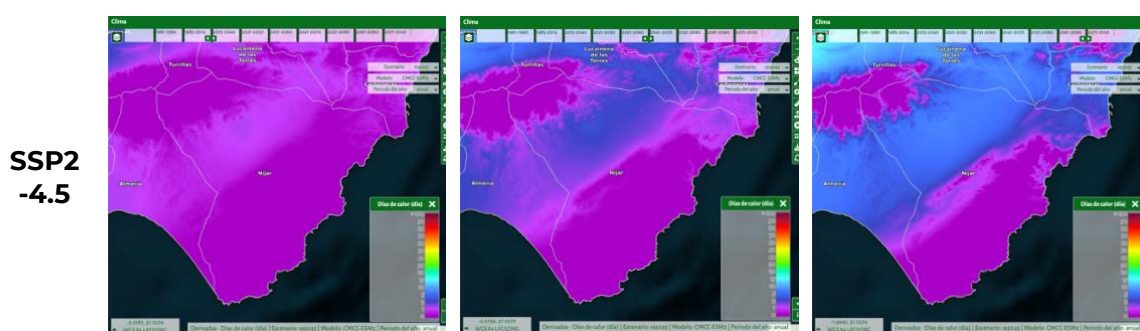


Image15. Climate scenarios for reference evapotranspiration (mm/day). Source: SICMA

As a consequence of the increase in temperatures and other factors such as solar radiation and wind, reference evapotranspiration is projected to increase to a total in the SSP5-8.5 scenario of 5.22 compared to 3.73 in the historical reference period. This increase, together with the decrease in precipitation, will intensify the aridity of the area and water stress on natural vegetation and available water resources.

Number of Hot Days (T_{max} ≥ 40 °C)



**SSP5
-8.5**

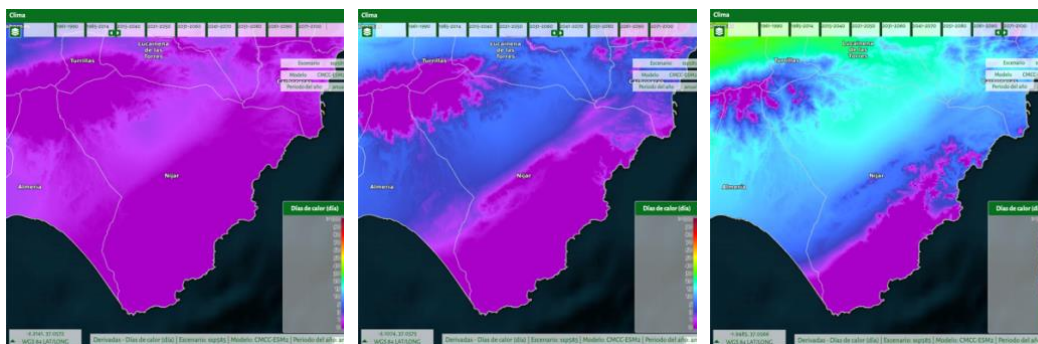
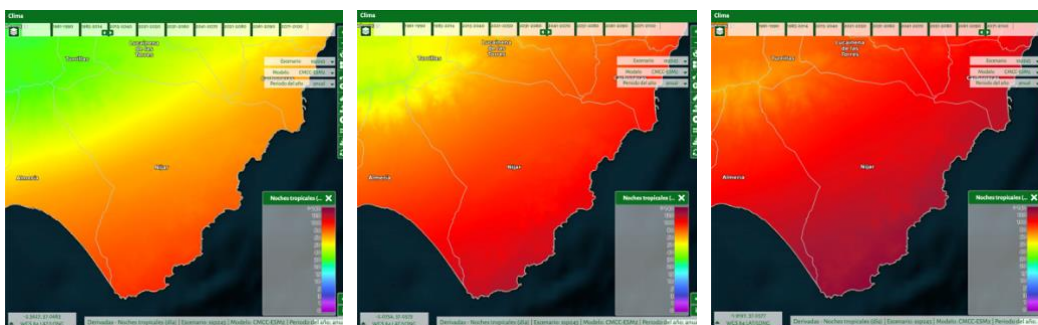


Image16. Climate scenarios for the number of hot days. Source: SICMA

A very significant increase in the number of extreme heat days is expected especially in the inland and northern areas of the park. While these were historically rare events in some areas of the Park, projections indicate that, especially under the SSP5-8.5 scenario and at mid and far horizons, these days could become much more frequent, with an increase of approximately 8 days per year, affecting thermal comfort and increasing fire risk.

Number of Tropical Nights ($T_{min} \geq 20^{\circ}\text{C}$ or $\geq 22^{\circ}\text{C}$)

**SSP2
-4.5**



**SSP5
-8.5**

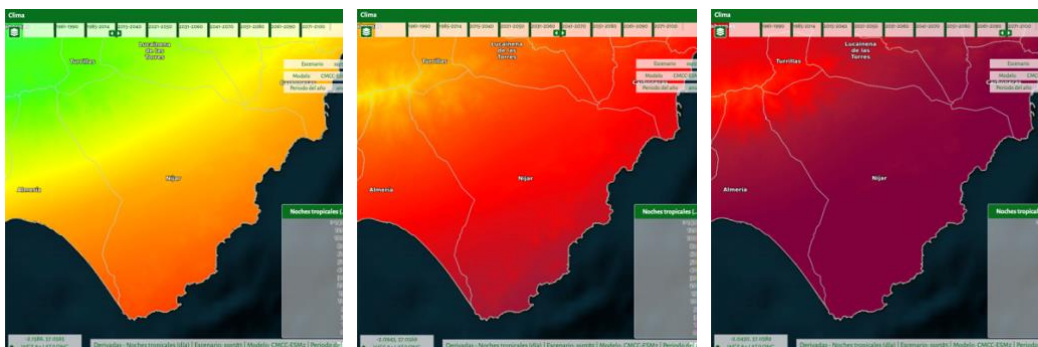


Image17. Climate scenarios for the number of tropical nights. Source: SICMA

The frequency of tropical nights will increase significantly under all scenarios and horizons. By the end of the century, under the SSP5-8.5 scenario, the number of tropical nights could increase by an additional 100 nights per year compared to the historical period. This will have a direct impact on the quality of sleep as well as on energy demand for air conditioning.

5.5. Final Considerations on Climate Analysis

The analysis of historical climate trends and future projections for the Cabo de Gata-Níjar Natural Park shows a panorama of increasing aridification, with significant increases in temperature in all its variables (average, maximum and minimum), a decrease and greater irregularity of precipitation, and an increase in the frequency and intensity of extreme phenomena such as heat waves, droughts and tropical nights. These changes will have profound implications for biodiversity, water resources, coastal morphology, fire risk and, very directly, for tourism, the park's main socioeconomic engine. A detailed understanding of these projections is the first step in designing effective adaptation strategies that will allow the Natural Park and its tourism sector to face the challenges of climate change and move towards a more resilient and sustainable model.

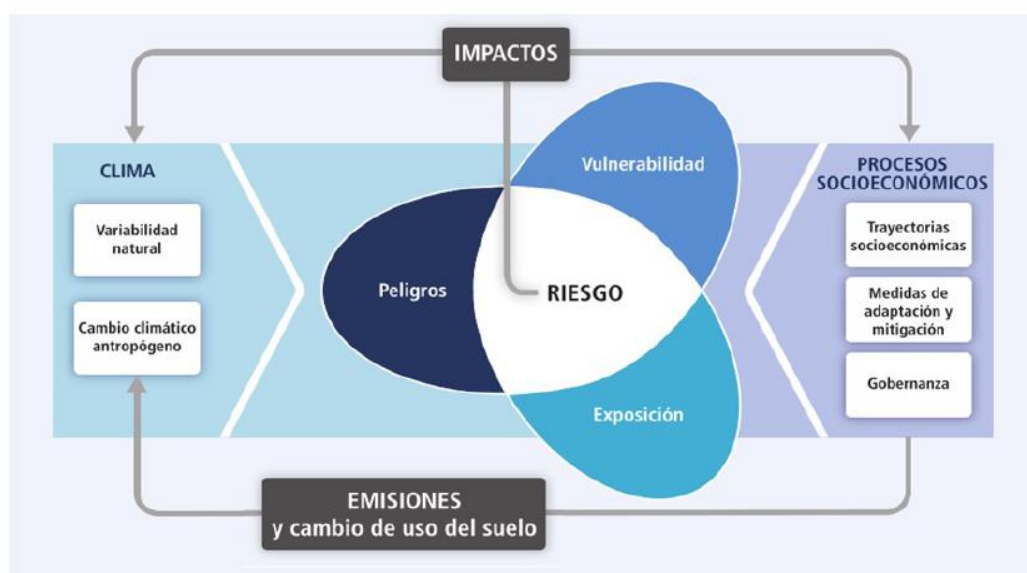
Variables	Trends under the climate scenarios analyzed (SSP2-4.5 and SSP5-8.5)
Average annual temperature	↑
Annual maximum temperature	↑
Annual minimum temperature	↑
Annual precipitation	↓
Reference evapotranspiration	↑
Number of hot days	↑
Number of tropical nights	↑

Table11 . Summary of climate trends under the climate scenarios analyzed (SSP2-4.5 and SSP5-8.5).

6. RISK ASSESSMENT OF CLIMATE CHANGE IMPACTS

According to the accepted definition by the international community addressing climate change adaptation, **risk** can be defined as *"the potential for adverse consequences for human or ecological systems, recognizing the diversity of values and objectives associated with such systems"* (IPCC AR5 and AR6). These adverse consequences include those related to human lives, livelihoods, health and well-being, economic, social and cultural assets, infrastructure, services, ecosystems and species.¹

Climate risk, in turn, is conceived as the result of the interaction of three components: threat or hazard, exposure and vulnerability.



Fuente: IPCC (AR5, 2014)

Image18. Theoretical description of climate risk. Source: IPCC (ARS, 2014).

¹ Regional Government of Andalusia. Consejería de Sostenibilidad, Medio Ambiente y Economía Azul (2023). *Methodological guide for the assessment and monitoring of climate risks in the framework of the Andalusian Climate Action Plan (PAAC)*. Oficina Andaluza de Cambio Climático. <https://www.juntadeandalucia.es/medioambiente/portal/documents/20151/128321653/Guia-Metodologia-Ev-Riesgos-V01.pdf>

The reference legislation at the regional level in the fight against climate change² identifies a series of key impacts that affect various sectors and strategic areas of the region.

Among the materials that feed the analysis of the risk of impacts on the Natural Park, the following official documents prepared at the municipal level in this context stand out: *Technical basis reports for the preparation and/or updating of the Municipal Plan against Climate Change* in the municipalities of Níjar and Carboneras (2025), as well as the *Municipal Plan against Climate Change in Almería* (2024).

6.1. Assessment of climate change impacts in the field of tourism

The following table presents the results of the risk assessment associated with the different impacts according to the aforementioned reference documents at the municipal level. The impacts are presented in order from highest to lowest risk according to the joint assessment for the three municipalities.³

Assessment of the risks associated with each impact at the municipal level.				
Impacts (art. 20 Law 8/2018)	Risks			
	Níjar	Carboneras	Almería	Total sum
j) Frequency, duration and intensity of heat and cold waves and their impact on energy poverty.	180	178,5	186,25	544,75
f) Changes in water resource availability and loss of quality.	66,75	154,5	208,5	429,75
b) Flooding of coastal areas and damage due to sea level rise.	120	210	76	406
g) Increased drought.	48	133,5	184,5	366
n) Population migration due to climate change. Particularly its demographic incidence in rural areas.	142,5	51	153	346,5
a) Floods caused by torrential rains and damage due to extreme weather events.	38,25	125	137	300,25

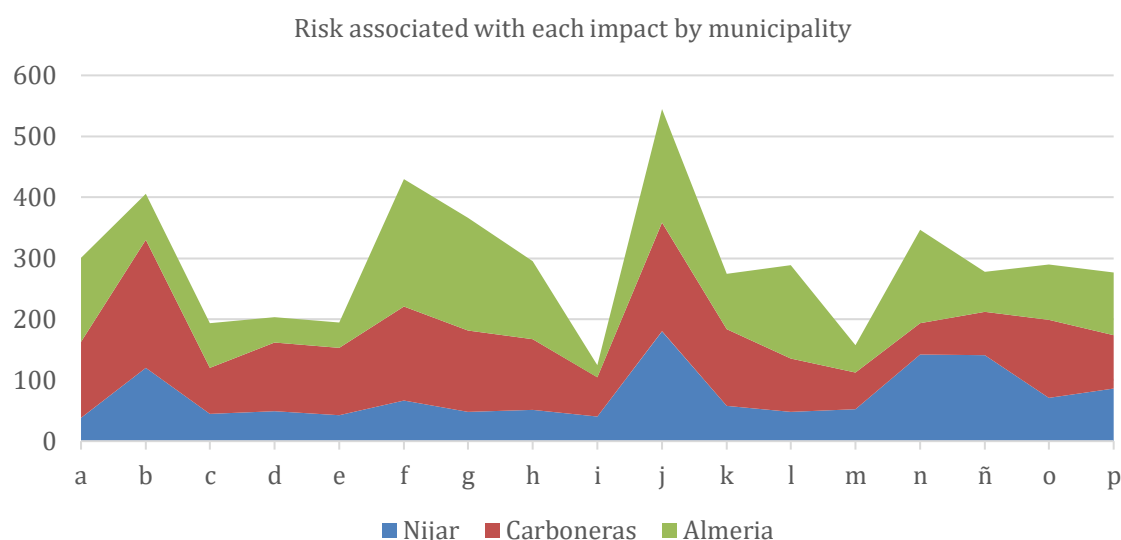
² Law 8/2018, of October 8, on measures against climate change and for the transition to a new energy model in Andalusia.

³ NOTE: The value of each risk is calculated by qualitatively combining the values of hazard (expected change in hazard intensity, CEIP, and time period in which the change is expected to occur, PTEC), exposure, sensitivity, and adaptive capacity (AC). Specifically, CEIP (1-3), PTEC (1-3) and exposure (0-3), sensitivity (1-3), and CA (1-3) scores are analyzed to determine the level of risk.

Assessment of the risks associated with each impact at the municipal level.				
Impacts (art. 20 Law 8/2018)	Risks			
	Nijar	Carboneras	Almeria	Total sum
h) Soil degradation, erosion and desertification processes.	51	116,25	127,5	294,75
o) Increase in the frequency and intensity of pests and diseases in the natural environment.	71	127,5	91,5	290
l) Seasonal change in energy demand.	48	87,5	153	288,5
ñ) Impact on human health.	141	71,25	66	278,25
p) Employment situation related to the strategic areas affected.	86	87,5	103,5	277
k) Changes in tourism demand and supply.	57,75	126,25	90	274
d) Changes in the frequency, intensity and magnitude of forest fires.	48,75	112,5	42	203,25
e) Loss of air quality.	42,75	110	42	194,75
c) Loss of biodiversity and alteration of natural heritage or ecosystem services.	45	75	73,5	193,5
m) Modifications in the electric system: generation, transmission, distribution, commercialization, acquisition and use of electric energy.	52	61	44	157
i) Alteration of the sediment balance in hydrographic basins and coastline.	40,5	64	20	124,5

Table12. Results of the risk assessment associated with the different impacts. Source: Prepared by the authors based on various sources, 2025.

The attached graph shows the contribution of each municipality to the total risk identified for each of the impacts:





Graph30 . Contribution of each municipality to the total risk for each impact. Source: Own elaboration from various sources, 2025.

The impacts with the highest risk in the municipalities of the NP are related to:

- Heat waves and drought.
- Availability and quality of water resources.
- Coastal flooding and sea level rise.
- Flooding due to torrential rains and extreme weather events.
- Population migration and impact on human health.

6.2. Descriptive assessment of the main impacts of climate change in the Natural Park.

Although climate change affects the entire municipal territory, there are specific impacts that, although they may have less quantitative relevance in the general calculation, have a special impact on the Cabo de Gata-Níjar Natural Park due to its unique biophysical, ecological and territorial characteristics. The fragility of its arid ecosystems, the low resilience of its soils and the high specialization of its biodiversity mean that certain climatic impacts pose a particularly critical threat to the ecological and functional integrity of the Park. Among them, the following stand out:

- Loss of biodiversity and alteration of natural heritage or ecosystem services.
- Changes in the frequency, intensity and magnitude of forest fires.
- Soil degradation, erosion and desertification processes.

The following is a descriptive summary of the most relevant impacts for the Natural Park.

a) Floods due to torrential rains and damage due to extreme weather events

The Natural Park is considered an area with an insignificant increase in flood risk in the different climate change scenarios⁴ assessed by the sectoral planning of reference.

⁴ Flood Risk Management Plan for the Hydrographic Demarcation of the Mediterranean basins of Andalusia (2022-2027).

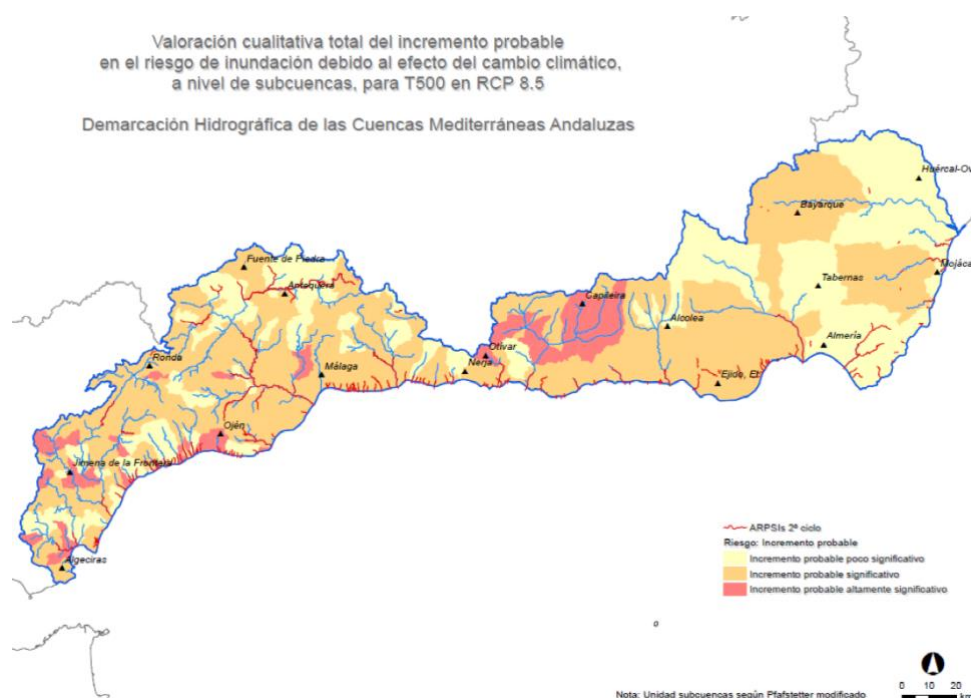


Image19. Risk of flooding due to the effect of climate change. Source: Flood Risk Management Plan of the Hydrographic Demarcation of the Andalusian Mediterranean basins (2022-2027).

However, the expected increase in heavy rainfall events in short periods of time, together with other territorial factors (change in land use, deforestation, forest fires, etc.) may lead to changes in watersheds that increase flows and, thus, the risk of flooding.

Phenomena such as DANAs (Isolated Depressions at High Levels) or cold drops typical of the Mediterranean area, which are part of the past and recent experience of the Natural Park, could increase in frequency and intensity, increasing their destructive capacity.

These phenomena are of crucial importance in the population centers of the NP area, where a large part of the natural drainage systems (wadis) have undergone a profound alteration and occupation, thus hindering their capacity to evacuate fluvial flows to the sea and, therefore, increasing the associated social and economic risks.⁵

Floodable area for a 500-year return period of the Pozo de Los Frailes Wadi, as it passes through the town of San José.

⁵ [1] Viciano Martínez-Lage, A. R. (2023). The coastline of the Cabo de Gata-Níjar Natural Park and climate change: estimates and future perspectives I and II. Eco del Parque, (21 and 22).



Image20 . Floodable surface. Source: Own elaboration based on the National Floodplain Mapping System, 2025.

b) Flooding of coastal areas and damage due to sea level rise.

Analysis of historical records at the national level shows a sea level rise of 1.58 ± 0.19 mm/yr from 1948 to 2019, with a sea level rise trend that was accelerated during the period 1993-2019.⁶

Short-term climate projections (period 2026-2045) suggest that sea level will continue to rise across the board, with forecasts for the Spanish coasts of between 0.13-0.17 m (± 0.03 m SD).

In addition to this rise of the sea, the temperature and acidity of the ocean, as well as the intensification of large storms and their associated meteorological tides.

All this implies serious impacts on the Natural Park, associated with the alteration of sensitive and particularly exposed ecosystems and species (wetlands, beaches, dunes and cliffs), the salinization of aquifers due to marine intrusion, and the accelerated erosion and loss of the coastline. Added to this

⁶ Vargas-Yáñez, M.; Tel, E.; Marcos, M.; Moya, F.; Ballesteros, E.; Alonso, C.; García-Martínez, M.C. 2023. Factors Contributing to the Long-Term Sea Level Trends in the Iberian Peninsula and the Balearic and Canary Islands. *Geosciences*, 13, 160. <https://doi.org/10.3390/geosciences13060160>.
<https://doi.org/10.3390/geosciences13060160>



are the repercussions on economic activities (tourism, agriculture), infrastructures and the population living along the coast.

c) Loss of biodiversity and alteration of natural heritage or ecosystem services.

Arid ecosystems, such as the Natural Park, are particularly vulnerable to variations in precipitation, temperature and evapotranspiration due to climate change. Similarly, the alteration of the biophysical and geochemical characteristics of the oceans and coasts (variation of the sedimentary balance of the coast, changes in surface temperature, salinity, alkalinity or ocean circulation, etc.), have an impact on the natural heritage of this protected area.

This alteration of the habitats that make up the Natural Park (dune systems, sandbanks, beaches and cliffs; salt marshes and wetlands; Mediterranean xerophytic scrubland; reefs and sea caves or *Posidonia oceanica* meadows, etc.), compromises the viability of related species, especially those with a more restricted distribution, also affecting the ecological structure, their functions and the services they provide. Economic activities directly or indirectly linked to this biodiversity, such as tourism, will also be affected.

d) Changes in the frequency, intensity and magnitude of forest fires.

Forest lands in Andalusia present a very high gross vulnerability to fires in the context of climate change, being the main threat to the survival of natural areas in the region, due to the serious ecological, social and economic losses involved, in addition to the risk to the population.

The excessive aridity of the province of Almeria limits the development of forest cover and consequently the risk of forest fires, being the province with the lowest number of forest fires (with an average of 50 fires per year for the period 1968-2008).⁷

However, in regions such as this one, where the water stress to which the sparse vegetation is subjected increases dehydration levels, they are particularly vulnerable to fire.

The severe increase in the number of days, as well as in the average and maximum temperatures, together with the periods of water scarcity associated with the climate change scenarios expected for the Natural Park, implies an increase in vulnerability and impacts caused by forest fires in the area of the NP.

f) Changes in the availability of water resources and loss of quality

⁷ Ministry of Environment. Regional Government of Andalusia. *Basic study of adaptation to climate change: Forest fire sector*. 2012

<https://www.juntadeandalucia.es/medioambiente/portal/documents/20151/998930/incendios.pdf>

The Andalusian region has a high sensitivity of water resources to climate change; however, these impacts are greater in arid or semi-arid geographic areas, such as the Natural Park, where water resource decreases of over 30% are projected for the end of the 21st century.⁸

These changes in the availability and quality of water resources caused by climate change are one of the greatest challenges for preserving the sustainability of socioeconomic activities and the well-being of the population in fragile areas such as the Cabo de Gata Natural Park, where aridity and water scarcity further aggravate the vulnerability of the territory.

g, h) Increased drought, soil degradation processes, erosion and desertification.

Drought is considered to be one of the most important impacts of natural origin in the Mediterranean area, with a significant effect in Andalusia, especially in more arid areas such as the Natural Park.

The increase in temperatures, together with water stress, implies a worsening of drought conditions which, in arid and semi-arid regions, also favor desertification processes.

Risk of desertification

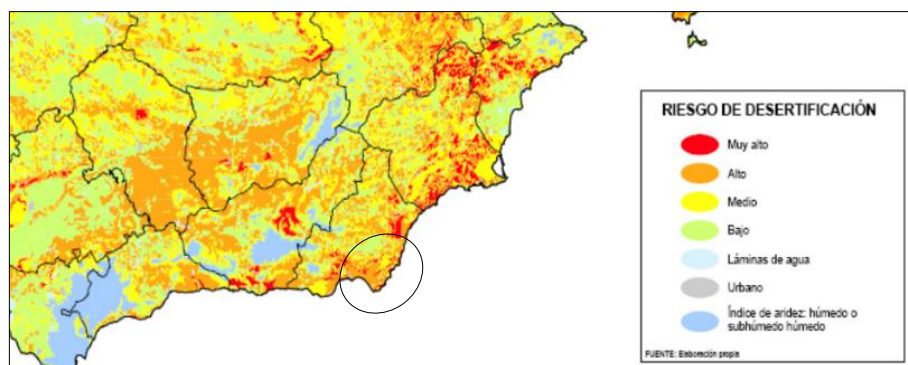


Image21. Desertification risk. Source: Desertification risk map. National action program against desertification. Ministry for Ecological Transition and Demographic Challenge, 2008.

The effects of these phenomena include soil degradation due to increased erosion, deterioration of its physicochemical and biological properties, with a consequent loss of fertility. In addition, greenhouse gases are released from the soil into the atmosphere and its potential as a carbon sink is reduced.

⁸ Junta de Andalucía (2021). *Andalusian Climate Action Plan 2021-2030*. Consejería de Sostenibilidad, Medio Ambiente y Economía Azul. Retrieved from https://www.juntadeandalucia.es/medioambiente/portal/landing-page-índice/-/asset_publisher/zX2ouZa4r1Rf/content/el-plan-andaluz-de-acci-c3-b3n-por-el-clima-2021-2030-/20151



The impact of drought and desertification is also particularly severe on habitats and species in environments that already survive with a limited margin at the survival threshold.

j) Frequency, duration and intensity of heat and cold waves and their impact on energy poverty.

The projections of climate change scenarios place the heat wave as an impact with high importance in the Andalusian region and especially in environments such as the Natural Park. These are episodes of abnormally high temperatures that are maintained for several days.

These scenarios have a direct impact on human health by increasing the risk of morbidity and mortality, in addition to affecting *thermal comfort*, or the sanction of well-being associated with adequate environmental conditions of temperature, humidity and air movement.

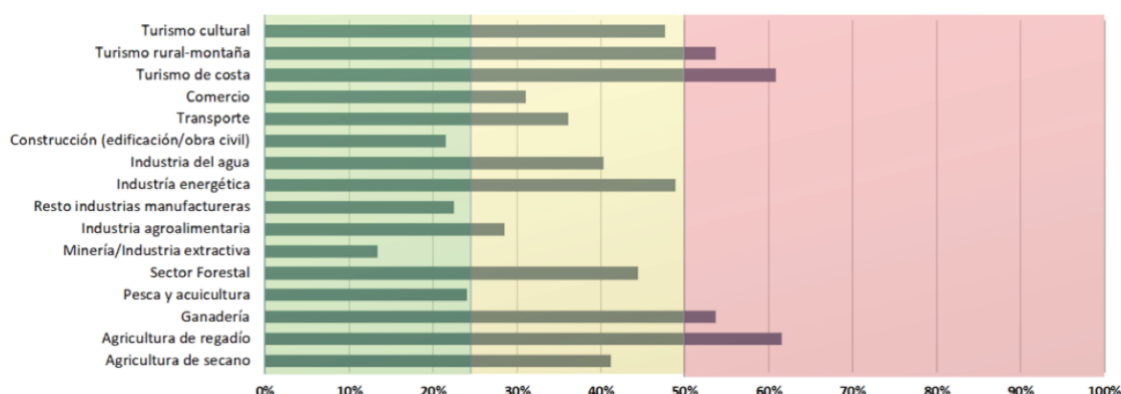
The economic and environmental impacts caused by heat stress in the Natural Park have a special impact on the natural environment, and also affect other sectors such as energy demand and, especially, the tourism sector.

7. VULNERABILITY OF TOURISM ACTIVITY IN THE NATURAL PARK TO CLIMATE CHANGE

7.1. Tourism and climate change

Tourism is the economic sector most exposed to the impacts of climate change in Andalusia as a whole, especially coastal tourism.

Risk assessment of the main economic sectors.



Graph31. Risk assessment of the main economic sectors. Source: PAAC 2021-2030

The technical reference documentation at the municipal level⁹, applies the official methodology for climate change risk assessment in relation to a set of strategic areas, including tourism.

The following table shows the result of this evaluation, where the strategic areas are presented in order from highest to lowest risk according to the joint assessment for the three municipalities:¹⁰

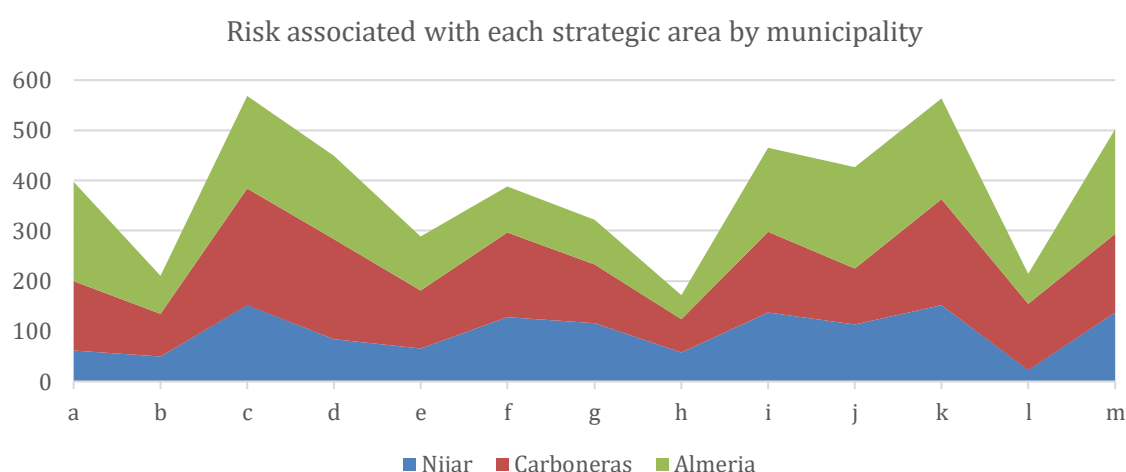
⁹ Technical basis reports for the preparation and/or updating of the Municipal Plan against Climate Change of the municipalities of Níjar and Carboneras (2025), as well as the Municipal Plan against Climate Change of Almería (2024).

¹⁰ NOTE: Risk is calculated by qualitatively combining the values of hazard (expected change in hazard intensity, CEIP, and time period in which the change is expected to occur, PTEC), exposure, sensitivity, and adaptive capacity (AC). Specifically, CEIP (1-3), PTEC (1-3) and exposure (0-3), sensitivity (1-3), and CA (1-3) scores are analyzed to determine the level of risk.

Assessment of the risks associated with each strategic area at the municipal level.				
Strategic areas	Risks			
	Nijar	Carboneras	Almeria	Total sum
c) Agriculture, livestock, aquaculture, fishing and forestry.	152,5	231,75	184,25	568,5
k) Tourism.	152	211,5	200,25	563,75
m) Migrations associated with climate change.	137,75	156,25	208	502
i) Health.	137,25	160,75	166,75	464,75
d) Biodiversity and ecosystem services.	84	199,75	165,75	449,5
j) Trade.	113	111,75	201,75	426,5
a) Water resources.	62	137,75	197,5	397,25
f) Urban and land planning.	128,5	168,5	91,25	388,25
g) Building and housing.	116,5	116	89,75	322,25
e) Energy.	66	115	107,25	288,25
l) Littoral.	22,5	131,5	61	215
b) Flood prevention.	50,25	84,25	76,5	211
h) Mobility and road, rail, port and airport infrastructure.	57	66,5	48,5	172

Table13. Assessment of the risks associated with each strategic area at the municipal level
Source: prepared by the authors based on various sources, 2025.

The attached graph shows the contribution of each municipality to the total risk identified for each of the strategic areas:



Graph32. Risk associated with each strategic area by municipality. Source: Prepared by the authors based on various sources, 2025.

Tourism is among the three strategic areas rated with the highest level of risk for the three municipalities, followed by others related to primary use (agriculture, livestock, aquaculture, fishing and forestry) and the human component (such as migration associated with climate change or health).

7.2. Evaluation of the risks associated with tourism in the municipalities within the scope of the NP

The following table shows the risk assessment¹¹ associated with each impact in relation to tourism according to the planning and reference documentation for the municipalities of the NP¹² with the reddest colors being the highest values and the green the lowest risk values:

Tourism-related risks and impacts matrix				
Impacts (art. 20 Law 8/2018)	Risks			
	Tourism in Níjar	Tourism in Carboneras	Tourism in Almería	Total sum
j) Frequency, duration and intensity of heat and cold waves and their impact on energy poverty.	27	22,5	18,75	68,25
p) Employment situation related to the strategic areas affected.	18	18,75	27	63,75
k) Changes in tourism demand and supply.	13,5	22,5	18	54
l) Seasonal change in energy demand.	6	15	27	48
ñ) Impact on human health.	27	7,5	6	40,5
f) Changes in water resource availability and loss of quality.	6	18	15	39
g) Increased drought.	3	18	18	39
n) Population migration due to climate change. Particularly its demographic incidence in rural areas.	12	6	18	36
e) Loss of air quality.	9	15	4	28
b) Flooding of coastal areas and damage due to rising sea levels.	3	18,75	3	24,75
d) Changes in the frequency, intensity and magnitude of forest fires.	9	12	2	23

¹¹ NOTE: Risk is calculated by qualitatively combining the values of hazard (expected change in hazard intensity, CEIP, and time period in which the change is expected to occur, PTEC), exposure, sensitivity, and adaptive capacity (AC). Specifically, CEIP (1-3), PTEC (1-3) and exposure (0-3), sensitivity (1-3), and CA (1-3) scores are analyzed to determine the level of risk.

¹² Technical basis reports for the preparation and/or updating of the Municipal Plan against Climate Change of the municipalities of Níjar and Carboneras (2025), as well as the Municipal Plan against Climate Change of Almería (2024).

c) Loss of biodiversity and alteration of natural heritage or ecosystem services.	4,5	10	7,5	22
m) Modifications in the electric system: generation, transmission, distribution, commercialization, acquisition and use of electric energy.	9	10	3	22
a) Floods caused by torrential rains and damage due to extreme weather events.	1,5	5	12	18,5
h) Soil degradation, erosion and desertification processes.	1,5	7,5	9	18
o) Increase in the frequency and intensity of pests and diseases in the natural environment.	2	3	12	17
i) Alteration of the sediment balance in hydrographic basins and coastline.		2		2

Table14. Matrix of tourism-related risks and impacts. Source: Prepared by the authors based on various sources, 2025.

The impacts that act as the main risk factor for tourism in the municipalities within the scope of the NP are all those that involve an effect on:

- Territorial resources related to the development of the activity
- Climatic comfort conditions
- The labor market related to the activity
- The dynamics of the tourism sector (supply and demand)
- Seasonal energy demand

7.3. Qualitative assessment of the main impacts of climate change and its current and future effects on tourism in the natural park.

Climate change represents a growing threat to tourism in the Cabo de Gata-Níjar Natural Park, a protected natural area whose economic development depends to a large extent on this activity.

The main effects of climate change on tourism activity in the Natural Park can be summarized as follows:

1. Degradation of the natural environment and loss of attractiveness of the destination:

Climate change may accelerate the degradation of the park's most sensitive ecosystems, such as wetlands, coastal areas, *Posidonia oceanica* meadows, and arid habitats, directly affecting its biodiversity, landscapes, and environmental quality. These elements form the basis of the Natural Park's tourist attraction, so their deterioration could reduce the value of the destination and limit its ability to continue attracting visitors in search of nature and authenticity.

2. Reduced climatic comfort and increased seasonality:



Rising temperatures and more frequent heat waves may make certain times of the year, especially summer, less attractive or even unhealthy for visitors. This could limit demand or shift it to preferable destinations.

3. Tensions over key resources such as water and energy:

The structural shortage of water, aggravated by drought and increased demand in high season, compromises the development of tourism activity, affecting the supply to accommodations, restaurants or tourist facilities, especially at peak times or times of greater affluence. Similarly, the increase in energy consumption for refrigeration or transportation, together with possible restrictions or higher prices, poses new challenges for the efficient and sustainable management of the destination.

4. Pressure on tourism infrastructure and services:

Extreme weather phenomena, such as torrential rains, fires or rising sea levels, can affect the operation and safety of tourist facilities, accommodations, access and evacuation systems. In addition, basic services (waste, sanitation, mobility) may become saturated during peak periods, especially if they are not adapted to the new climatic conditions.

5. Socioeconomic impacts on the local population:

A reduction in the quality or stability of tourism activity has a direct impact on local economies, which are highly dependent on this sector. This can result in the loss of seasonal jobs, a decrease in income for small businesses, and an increase in social vulnerability, especially in rural areas with less adaptive capacity. In Carboneras, the service sector represents 75.24% of employment contracts and 36.65% of the business fabric (21.50% commerce and 15.15% hotels and restaurants), with a consolidated tourist infrastructure that in 2022 had 20 accommodations and almost 600 vacancies available. In Níjar, although agriculture continues to dominate with 61.18% of the companies, the service sector generates 52.22% of the contracts, and the hotel and catering industry constitutes 6.08% of the total number of companies. These data reflect the importance of tourism in both municipalities, both for its direct weight and its capacity for economic and labor dynamization.

8. GENERAL RECOMMENDATIONS FOR THE CLIMATE ACTION PLAN

8.1. SELECTION OF KEY CRITERIA AND INDICATORS

The Cabo de Gata-Níjar Natural Park is one of the most unique protected areas in the western Mediterranean. Its biodiversity, volcanic landscapes and well-preserved coastline have consolidated it as a booming tourist destination, especially linked to the enjoyment of nature. However, this tourist activity, the main economic engine for many localities in the park, also exerts increasing pressure on a fragile environment with limited resources.

The current tourism diagnosis identifies several key aspects that serve as a basis for establishing criteria for the issuance of recommendations:

- The need to move towards a sustainable mobility model that reduces carbon footprint
- Strengthening of environmental awareness among visitors and companies
- Active protection of natural and cultural heritage
- Improving coordination between administrations and local stakeholders
- Diversification of the tourism offer to promote a more sustainable and less seasonal activity.

Against this backdrop, climate change is a structural challenge. The natural values that make this territory attractive - its climate, landscape and biodiversity - are also the most vulnerable to the effects of global warming. Water scarcity, soil erosion, pressure on infrastructures and overloading of sensitive areas are factors that already limit the park's carrying capacity and could worsen in the coming years.

Ensuring the sustainability of tourism in the Natural Park requires an integrated response that combines environmental conservation measures with mitigation strategies and economic and social adaptation to the new scenarios posed by climate change.

8.2. ACTION PLAN RECOMMENDATION

This section includes a set of strategic recommendations that serve as a preliminary basis for the subsequent development of an Action Plan aimed at strengthening the resilience of tourism in the Cabo de Gata-Níjar Natural Park in the face of climate change.

These recommendations have been defined on the basis of the diagnosis carried out, which has made it possible to identify the main pressures,

vulnerabilities and opportunities of the territory in relation to tourism sustainability and the foreseeable impacts of climate change. They have been organized around five key axes that address environmental, economic, social and governance aspects in a cross-cutting manner.

The objective of this proposal is to offer an initial roadmap to guide the definition of concrete measures to mitigate the effects of climate change and to adapt the current tourism model to the new scenarios, guaranteeing the conservation of the natural environment, economic sustainability and the quality of life of the local population and the tourism experience itself.

The recommendations of the Action Plan are grouped into 5 Axes:

- MLA1. Strengthen the **conservation status** of the ecosystems and species most vulnerable to climate change through nature-based solutions.
- Reformulate the **tourism model** towards a more sustainable offer adapted to climate change.
- Adapt the **territorial metabolism of the tourism system** to the new climate scenario.
- MLA4. Strengthening the **awareness and participation** of local citizens and visitors in the foreseeable effects of climate change.
- MLA5. Promote a solid **governance system** aligned with the development of the strategies needed to address the climate crisis.

These axes are developed along the **following strategic lines**:

AXIS1.

Strengthen conservation status of ecosystems and species most vulnerable to climate change through nature-based solutions.

The Cabo de Gata-Níjar Natural Park, as a tourist destination, depends closely on the ecological value and good conservation status of its ecosystems, which are particularly sensitive to climate change. In this context, it is necessary to promote measures that mitigate the impact of human activity and reinforce the resilience of the territory in the face of the degradation processes already underway. The actions contemplated in this axis should be aligned with existing official conservation and ecological restoration programs and initiatives, ensuring coherence and continuity in environmental management. The formulation and implementation of the measures will be done in collaboration with the scientific community and other specialists involved in the study and conservation of the natural park.

1.1 Improved knowledge of the effects of climate change on the most vulnerable species and habitats as a basis for adaptive management.

This line promotes the improvement of knowledge on the effects of climate change on the most vulnerable habitats and species in the Park. It will include the identification of sensitive areas, risk mapping and the promotion of collaborative studies with scientific organizations, with the aim of guiding effective and territorially contextualized adaptive management measures.



1.2 Ecological preservation in degraded areas and ecosystem resilience

This line promotes the **preservation and, where appropriate, active restoration of ecosystems** that are more sensitive to the impacts of tourism in a context of climate change (on beaches, salt marshes and wetlands, wadis or dune areas or seagrass meadows). The development of actions under a nature-based solutions approach will be encouraged to strengthen the functional resilience of habitats in the face of climate change, while generating ecological and social benefits.

1.3 Adaptive management of public use and tourist traffic

This line proposes a reorganization of public use based on ecological sensitivity and adaptation to climate change. The possibility of creating a dynamic zoning for preservation, the reorganization of trails and accesses, and the implementation of dynamic information systems that regulate the flow of tourists based on the state of conservation of ecosystems and environmental conditions.

AXIS2.

Reformulate the tourism model towards a more sustainable offer adapted to climate change by implementing constant measurement.

This axis raises the need to reorient the current tourism model in the Cabo de Gata-Níjar Natural Park, moving towards a tourism offer and products that are compatible with the new climatic scenarios, with less environmental impact, greater economic resilience and greater added value for the territory.

Product diversification, the incorporation of climatic criteria in business management, and the promotion of tourism modalities consistent with the park's values are key to ensuring a more **adapted and sustainable** tourism, both socially and ecologically.

2.1 Measuring and reducing the carbon footprint of tourism in the park

Promote tools to measure the **carbon footprint per overnight stay and tourist activity**, in collaboration with lodging facilities and operators. Promote reduction measures (energy efficiency, sustainable mobility, proximity consumption) and move towards a "low-emissions tourism" model.

2.2 Measurement and monitoring of key tracking indicators

Incorporate key indicators that allow continuous monitoring of the impact of tourism on climate change and its evolution. This monitoring should be integrated into tourism management planning and evaluation processes, facilitating evidence-based decision making.

The indicators proposed to be monitored are aligned with deliverable **D.1.4.1-2 Methodological frameworks for Regions and Destinations** of the project, which establishes a multidimensional approach to assess the main challenges of coastal tourism in relation to climate change. This



methodological framework, developed in the context of the *NaTour4CChange* project itself, proposes a structure based on five key dimensions: **physical and environmental, economic, socio-cultural, governance and policy, and biodiversity and ecosystem health.**

In line with this work, the indicators proposed here allow a holistic approach to monitoring adaptation to climate change in the Natural Park. They are also designed to facilitate their integration into existing monitoring systems, encourage the participation of local stakeholders and enable the comparability of results at regional and Mediterranean level.

PHYSICAL AND ENVIRONMENTAL INDICATORS

- **Variation in mean annual temperature**
- **Number and frequency of days of extreme heat**
- **Days of extreme precipitation**
- **Sea water temperature evolution**

ECONOMIC INDICATORS

- **Evolution of tourism businesses in the NP area**
- **Investments made by the tourism sector to adapt to climate change**
- **Variability of tourism sector revenues**
- **Insurance costs**

SOCIO-CULTURAL INDICATORS

- **Tourists' satisfaction with their experience in the Natural Park**
- **Perception of the local population on tourism in the NP**
- **Number of awareness campaigns conducted on climate change awareness**

GOVERNANCE AND POLICY INDICATORS

- **Number of climate adaptation policies in the tourism sector**
- **Involvement of local stakeholders in decisions related to climate change and tourism**

BIODIVERSITY AND ECOSYSTEM HEALTH INDICATORS

- **Water quality in beaches and natural areas for recreational use**
- **Surface area affected within protected areas due to tourism or climate impacts.**

It is recommended that this monitoring be carried out periodically (annually or biennially), with the support of data available at the local, regional, and national scales, and with the participation of park management entities, tourism agents, and research centers.



2.3 Seasonal adjustments, diversification of tourism supply and services in a climatic key towards eco-adapted modalities

Promote **alternative tourism products** to the seasonal coastal model, favoring experiences linked to geological heritage, the observation of terrestrial and marine ecosystems, cultural and ethnographic resources or agrotourism, among others, less dependent on extreme weather and with greater capacity for deseasonalization. The adaptation of tourist services (accommodation, restaurants, etc.) to meet non-seasonal demand is also envisaged.

2.4 Sustainable mobility and tourism access management

Reorient the model of access to the Park towards a **low-emission mobility**, regulated and adapted to the capacity of the territory in line with the initiatives proposed for this space so far (such as the 2014 Mobility Management Plan for Habitats of Community Interest or the Nijar Smart Cabo de Gata project). Possible actions such as the implementation of seasonal public transport systems, restrictions on private vehicles supported by alternative access systems in sensitive and/or saturated areas (such as dissuasive parking and shuttles) or the promotion of non-motorized means, as well as possible improvements in infrastructure and signage will be assessed.

2.5 Positioning the Park as a natural sanctuary for sustainable tourism

Consolidate the Park's image as a **benchmark for low-impact tourism**, in harmony with its biodiversity, geological uniqueness and conservation vocation. Promote tourism that brings social, cultural and environmental value to the territory, aligned with the principles of the European Charter for Sustainable Tourism and in line with the principles agreed upon in the Glasgow Declaration.

2.6 Climate risk assessment in tourism business activity

Promote **climate risk assessment in tourism businesses** in the Park as a planning and adaptation tool. Provide training and technical advice to identify vulnerabilities (water, extreme heat, mobility, etc.) and design responses that **protect their viability and competitiveness**.

AXIS3.

Adapting the territorial metabolism of the tourism system to the new climate scenario

3.1 Energy transition of the tourism system



Promote connected self-sufficiency¹³ in energy supply systems, based on renewable energies. Improve energy efficiency, passive air conditioning systems and control of electricity consumption, adapted to the climatic context of the Park.

3.2 Sustainable and climate-adapted water management

To promote the optimization of water use in tourist establishments through nature-based solutions for rainwater collection and filtering, saving and reuse in an environment that is particularly vulnerable to water scarcity.

3.3 Waste minimization and circular economy in tourism

Reduce the generation of tourist waste, promote composting and local recycling. Improve current waste collection and separation systems to ensure the quality and efficiency of the service. Reinforce the implementation of circular models in accommodations and services (e.g., substitution of single-use packaging, reuse of materials, reverse logistics systems).

3.4 Proximity food and sustainable food systems

Encourage the sourcing of zero-kilometer agri-food products in tourist establishments, as well as sustainable cooking practices and menus adapted to local availability, contributing to food resilience and the local economy.

3.5 Bioclimatic adaptation of tourism infrastructure

Promote the redesign or adaptation of infrastructures (housing, accesses, public facilities) with bioclimatic criteria, thermal impact reduction, landscape integration and resistance to extreme events, ensuring their functionality in future climate scenarios.

AXIS4.

Strengthening the awareness and participation of all stakeholders involved in tourism in the face of the foreseeable effects of climate change.

This axis seeks to consolidate a shared climate culture among the different actors in the Cabo de Gata-Níjar Natural Park - the tourism sector, the resident population and visitors - that will contribute to strengthening its collective capacity to adapt. The active involvement of society is essential to ensure the effectiveness of the measures proposed in the previous axes.

¹³ Principle of **connected self-sufficiency**, according to which the territory optimizes its capacity to generate renewable energy from its own resources, thus increasing its self-sufficiency, without being disconnected from the grid, as a support or complement to its own generation capacity. Source: Requejo Liberal, J., & Jiménez Beltrán, D. (2018, September 20). *Connected self-sufficiency. Adjusting to what we have*. La Información.



4.1 Awareness and co-responsibility in the tourism sector

This line seeks to actively involve the tourism sector in adapting to climate change through training and awareness campaigns, with emphasis on its role as a key player in reducing environmental impacts (water and energy footprint, waste, transportation) and as a channel for transmitting good practices. Their active involvement will be encouraged in the dissemination of the PRUG regulations and in the responsible management of the territory. A culture of co-responsibility that aligns tourism activity with the park's conservation objectives will be promoted.

4.2 Active involvement of the resident population in climate change adaptation.

Encourage the participation of local citizens in adapting to climate change through community processes, campaigns and workshops focused on water and energy saving, waste management, sustainable mobility and compliance with the rules of use of the protected area. Priority will be given to territorial rootedness, intergenerational transmission and activation of local networks.

4.3 Raising visitor awareness of responsible tourism adapted to the environment

Develop content and materials aimed at visitors that provide clear and accessible information on the effects of climate change in the park, good practices in the use of resources and mobility, and the need to respect the rules established for conservation. The development of face-to-face and digital actions at key points of entry, lodging and interpretation centers will be considered.

AXIS5.

Promote a governance system aligned with the development of the necessary strategies to address the climate crisis.

This axis aims to strengthen the climate governance of the Cabo de Gata-Níjar Natural Park, providing it with a more integrated, participatory and adaptive basis, in line with the principles and recommendations contained in initiatives such as the LIFE ADAPTAMED project on adaptive governance in this natural area. This approach will make it possible to move towards a more coherent, transparent and resilient decision-making system, capable of responding effectively to the challenges of climate change and tourism from a territorial and shared perspective.

5.1 Integrate the socio-ecosystemic and adaptation approach in the planning and management of the park.

Revision of current planning and management instruments that require it (PRUG, PORN, PDS, sectoral plans), to assess their suitability for the present



time, incorporating a systemic perspective for management aimed at preserving the ecological functionality of the territory in a context of climate crisis.

5.2 Strengthen the inclusive and active participation of social agents in all phases of the management cycle.

Establish broad, accessible and structured participation processes that integrate citizens, local groups and key stakeholders from the outset, guaranteeing the co-design and social acceptance of the measures, and fostering a culture of dialogue to prevent conflicts.

5.3 Consolidate multilevel governance structures, inter-administrative cooperation and multisectoral networks.

Promote coordination between administrations, sectors and territorial scales, as well as the creation of spaces for collaboration and alliances that favor policy coherence, the integration of diverse visions and the exchange of experiences.

5.4 Promote knowledge co-production and adaptive monitoring systems.

Promote applied research, the generation of socio-ecological indicators and the creation of spaces for exchange between science, management and society. Facilitate open information channels that reinforce collective learning and allow the plan to be adjusted according to the evolution of the territory and the climate.