

NATIONAL

CLIMATE CHANGE

ADAPTATION

PLAN 2021 - 2030



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VICEPRESIDENCIA
CUARTA DEL GOBIERNO

MINISTERIO
PARA LA TRANSICIÓN ECOLÓGICA
Y EL RETO DEMOGRÁFICO



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NATIONAL
CLIMATE CHANGE
ADAPTATION PLAN
2021 · 2030



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PRE-
AMBLE

PREAMBLE: A NEW IMPETUS FOR CLIMATE CHANGE ADAPTATION

Climate change is now a reality and its impacts can be seen in all regions of the planet through an ever-increasing set of signs. The data provided by systematic observation are conclusive.

The Spanish Meteorological Agency (AEMET, in Spanish) Climate Open Data initiative has gathered the most relevant evidence of the impacts of climate change in Spain¹ and has demonstrated that there are already more than 32 million people directly affected by the consequences. A climate change scenario has been confirmed and it has visible effects, such as the expansion of semi-arid climates, the lengthening of summers (almost 5 weeks longer than in the early 1980s), a greater number of days of heat waves and tropical nights, and a 0.34 °C increase in the surface temperature of the Mediterranean per decade. The data show that large cities and the Mediterranean coast – fundamental pillars of Spain's wealth – are particularly hard hit, making them especially vulnerable to climate change.

The scientific community is clear on the future outlook. The Intergovernmental Panel on Climate Change (IPCC) special report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global emission pathways, published 8 October 2018, is particularly compelling.

In an inescapable call for accelerated action on climate change, the report explains that the most optimistic scenario – a 1.5°C rise in global temperature – has fatal con-

sequences for the lives of people. And that exceeding that limit and reaching a warming of 2°C, a prospect that cannot be ignored, will have even more serious effects: twice as many droughts, twice as many heat waves and twice as many species going extinct, among others.

The report clearly identifies that the countries of the Mediterranean Arc will be particularly hard hit by the impacts of climate change. It highlights, for example, that the reduction in runoff in the Mediterranean area will be almost twice as great with a warming of 2°C as compared to a warming of 1.5°C. It also identifies West Africa and, therefore, the Canary Islands marine strip, as a critical area in terms of climate change.

Spain, therefore, due to its geographical location and socio-economic characteristics, faces significant risks derived from climate change. Key sectors of the economy, such as agriculture, forestry, tourism and transport, depend heavily on the climate, but so do many other areas that are essential to well-being, such as human health, biodiversity and housing.

Climate change is a challenge to Spain from social, economic and civilizational perspectives. This challenge requires an urgent response, with the primary objective of slowing global warming, but, at the same time, it also demands responses to the already evident impacts of a warmer, more extreme and uncertain climate.

¹ - http://www.aemet.es/es/noticias/2020/07/Informe_anual_estado_del_clima_2019

RESPONSABILITY TO FUTURE GENERATIONS

To reach the 1.5°C target that would enable us to comply with the Paris Agreement and avoid the worst effects of climate change, global CO₂ emissions will need to be substantially reduced over the coming decades. This means that today's young people will have a lower "carbon budget" over the course of their lives than their parents did, as well as being exposed to significant impacts of climate change.

2019 marked a paradigm shift: young people began to take a leading role in the fight against climate change, demanding that a climate emergency be declared on the basis of scientific knowledge and the human and ethical consideration of the challenge, and that ambitious policies be implemented as a matter of urgency.

At the United Nations Climate Change Conference held in Madrid in December 2019, the Government of Spain signed a declaration that reflects the priorities identified by children and young people from around the world. In the declaration, Spain made, among others, the following commitments:

- *Scale up efforts to respect, promote and consider the rights of children and young people in the implementation of the Paris Agreement at all levels, including recognition of their specific vulnerabilities, as well as their status as key actors and implementers, in countries' national climate adaptation and mitigation measures, Nationally Determined Contributions (NDCs), National Adaptation Plans (NAPs) and long-term greenhouse gas emission development strategies, including consideration of the particular role and responsibilities of the private sector;*
- *Urgently increase and accelerate investment in adaptation measures, disaster risk reduction and mitigation corresponding to children and young people, with a particular*

focus on reaching the most at-risk children and adolescents, and advocate for criteria sensitive to children and young people to be integrated into multilateral funds.

- *Strengthen the capacity of children and young people in climate change mitigation and adaptation efforts by establishing and investing in environmental and climate change education, equipping children and young people with the knowledge and skills required to protect themselves and contribute to a safe and sustainable future, ensuring that these efforts reach marginalized children and young people.*
- *Optimise the meaningful participation of children and young people in climate change processes, including through the Action for Climate Empowerment Dialogue, participating in the Youth Delegate Programme at the United Nations Framework Convention on Climate Change, UNFCCC, and supporting the YOUNGO Global South Scholarship.*
- *Actively consider and explore measures to establish an International Commission for Children and Future Generations, as well as mechanisms at national level to guarantee the effective participation of children and young people in decision-making on climate change.*

The future of young people must be at the centre of the response to the current COVID-19 crisis and to systemic crises such as climate change and biodiversity. This PNACC and other instruments of the energy and climate framework are setting the foundations for sending the right message to the whole of society and for attracting the necessary investments for a new cooperative and inclusive carbon-neutral model that responds to the demands of young people and secures the future they deserve.



In this context, adaptation to climate change comprises a broad set of strategies aimed at avoiding or reducing the potential impacts of climate change, as well as promoting better preparation for damage recovery.

Effective adaptation actions reduce the exposure and vulnerability of social, economic and environmental systems to climate change and can also improve their capacity to recover and re-establish after climate-related disruption.

In terms of the risks to be avoided, adaptation is a recognised need from perspectives as diverse as ethics, ecology and the economy:

- From an **ethical** point of view, it is imperative that the public authorities take

responsibility for the protection of citizens, paying special attention to the populations and territories that are most vulnerable and exposed to climate change, where its effects are most accentuated and which have the least resources for adaptation, avoiding a rise in social inequalities.

- From an **ecological** point of view, it is essential to conserve natural heritage, biodiversity and the ecosystem services they provide, whose contribution to humans may be eroded by the effects of climate change.
- Furthermore, the economic impacts of climate change without adaptation responses substantially outweigh the costs of adaptation, justifying adaptive interventions from an **economic perspective**.

Adaptation not only prevents or minimises damage, but it also brings about benefits that justify the measures:

- **Adaptation to climate change provides economic and social stability and opens up new opportunities:** Investments in planned adaptation, whether public or private, not only prevent and reduce the risks posed by climate change to the existing economy and employment, but they can also create new economic activities and employment opportunities, while preventing economic losses and promoting a more resilient economy.

According to the Global Commission on Adaptation report², the rate of return on investments in resilience enhancement is very high, with a cost-benefit ratio ranging from 1:2 to 1:10, and even higher in some cases. This means that every euro invested in adaptation could result in net economic benefits of between 2 and 10 euros.

- **Adaptation has many co-benefits:** Adaptation actions can produce additional positive effects in areas such as natural heritage conservation, health protection, even climate change mitigation³ and collective security⁴.

² - Global Commission on Adaptation (2019). *Adapt now: a global call for leadership on climate resilience*. Accessible en: https://cdn.gca.org/assets/2019-09/GlobalCommission_Report_FINAL.pdf

³ - For example, adaptation actions aimed at limiting the impacts of climate change on ecosystems allow them to maintain their strategic role as carbon stores and sinks, contributing to climate change mitigation.

⁴ - Environmental degradation and climate change are increasingly identified as sources of threats to collective security, as the degradation of ecosystems and the increased frequency or intensity of extreme events (such as droughts, forest wildfires and heat waves) are a growing cause of emergencies and forced displacement.

The presentation of the second National Climate Change Adaptation Plan (PNACC, in Spanish) 2021-2030 was one of the commitments established in the Council of Ministers' agreement of 21 January 2020 approving the Government's Declaration on the Climate and Environmental Emergency.

The National Climate Change Adaptation Plan 2021 - 2030 aims to respond to the growing need to adapt to climate change in Spain, as well as to the international commitments in this field, laying the foundations to promote a more climate change-resilient development over the next decade in order to build a safer and more inclusive country.

The PNACC 2021-2030 broadens the issues addressed, the actors involved and the ambition of its objectives. For the first time, the PNACC establishes strategic objectives and defines a system of indicators for impacts and adaptation to climate change, as well as the preparation of risk reports. In short, a new governance based on the lessons learned from Spain's first National Adaptation Plan, which systematised the risks, the responses to those risks and the monitoring of their effectiveness.

INTEGRATED RESPONSES TO CLIMATE CHANGE

The design of the PNACC revolves around the conviction that promoting adaptation does not mean abandoning climate change mitigation. In fact, mitigation and adaptation are two complementary strategies in the face of climate change: ambitious global mitigation policies will reduce the needs and costs of adaptation, and without sufficient mitigation efforts, our adaptive capacity will be overwhelmed.

In addition, adaptation to climate change can enhance CO₂ absorption and storage processes through adaptive and anticipatory management of natural systems. On a social level, the changes in behaviour and lifestyle necessary for adaptation to climate change are complementary to those required for the reduction in greenhouse gas emissions.

The new National Climate Change Adaptation Plan 2021-2030 is part of the strategic energy and climate framework, a set of instruments including the Draft Climate Change and Energy Transition Bill (CCyTE Bill, in Spanish), the long-term strategy for a modern, competitive and climate-neutral economy by 2050, the National Integrated Energy and Climate Plan for 2021-2030 and

the Just Transition strategy. These documents also include climate change adaptation and have clear connections to the new PNACC.

This is the institutional framework for coordinated action, in compliance with the Paris Agreement, involving science and society as a whole. It has been put in place to

facilitate the progressive alignment of the country's reality with the requirements governing climate action in a clear manner, establishing the conditions and tools to achieve climate neutrality in advance by 2050 and providing the certainty needed to mobilise action and investments from all actors, public and private.

It promotes a change in the production, energy and consumption model, aimed at strengthening the industrial and business fabric, generating decent employment, reducing inequalities, enhancing the value of rural development, creating safer and more sustainable cities and protecting biodiversity, natural capital and our health.

To achieve these objectives, it establishes a new form of governance, which guarantees the coherence of climate action and sets out new practices for public administrations and the private sector in terms of the way they legislate, plan, budget, manage and report. It regulates new models of public-private participation and public policy advice and control, such as the creation of a "Committee of Experts on Climate Change and the Energy Transition" and the "Citizens' Climate Change Assembly".

TOWARDS A SHARED VISION OF THE RISKS OF CLIMATE CHANGE

Adaptation to climate change aims to reduce risks to levels that are acceptable for society and nature as a whole, both now and in the future. However, defining what constitutes an acceptable level of risk is the result of a political process, which has to take into account technical assessments of the risks and the costs associated with the different options for managing them.

However, perceptions of what constitutes an acceptable level of risk can be very diverse; levels of risk tolerance or risk aversion may reflect different levels of information, interests, values and expectations. It is important to recognise that judgments made about whether a particular risk is acceptable or not will condition the selected responses.

AN INCLUSIVE APPROACH TO RISK MANAGEMENT

For adaptation policies and measures to respond to social interest and achieve broad support, it is necessary to develop a shared vision of the risks and distribute the responsibilities evenly among key actors. Turning adaptation into a challenge shared by society will be easier if interested or affected parties have relevant information about the risks that affect them. Therefore, the PNACC outlines an informed debate within communities about the risks pertinent to them and the value of the preventive measures to manage them, and it includes programmes to inform and prepare potentially affected people about the measures to take in emergencies and situations of imminent risk.

THE COVID-19 CRISIS AND ADAPTATION TO CLIMATE CHANGE

The SARS-CoV-2 pandemic, causing the disease known as COVID-19, has highlighted the fragility of our societies in the face of global threats. In this sense, the experience of COVID-19 provides valuable lessons that can be transferred to the fight against the risks arising from climate change. The following are some of the most relevant:

The importance of recognising global risks: Pandemics and climate change have something important in common: they are global risks that can lead to systemic impacts. Because of their global dimension, society has valued these threats as too abstract and too distant. However, global does not mean that they occur far away, it means that they can be expressed anywhere.

The vulnerability of the Spanish economy and society: The COVID-19 pandemic has highlighted the global dimension of the risks associated with crises. One of the most significant of these is the disruption to markets and global supply chains, which reveal the need for a certain degree of self-sufficiency in basic or strategic products and services.

The importance of anticipating expected impacts: Adequate preparation prevents risks from overwhelming us and it limits the impacts when episodes of crisis occur. The emergency services and the civil protection system are playing an invaluable role in the difficult circumstances brought about by the pandemic.

The protective role of nature: The conservation of healthy natural systems and their biodiversity not only provides pro-

tection against zoonoses, such as COVID-19, but also against the effects of climate change. In the field of adaptation, "nature-based solutions" aim to harness the best of this protective role, not only in rural areas but also in cities.

The commitment of Spanish society: In the face of COVID-19, Spanish society is setting an historic example in solidarity and commitment, demonstrating the critical importance of a society that adequately recognises a threat and pulls together to confront it, applying the necessary self-protection measures and looking after the most vulnerable groups.

The importance of adequate systems of governance: Responses to complex threats, which are expressed through a diverse set of effects, require governance systems that enable the effective implementation of measures, institutional coordination and public-private collaboration.

The need to review priorities: The pandemic is a painful wake-up call on the need to prioritise the defence of life and the protection and care of the elements that sustain it. This is a basic premise that must be used to inspire climate change adaptation policies and measures.

THE PNACC AND THE EUROPEAN COUNCIL AND COMMISSION CONCLUSIONS ON SOCIAL AND ECONOMIC RECONSTRUCTION

Adaptation is a line of climate action with enormous potential in Europe and Spain to contribute to the recovery from the damage caused by the COVID-19 pandemic and to strengthen the resilience of socio-economic and environmental systems in the face of the impacts of climate change.

Regular European funds (Multiannual Financial Framework, MFF, 2021-27) and exceptional funds (Next Generation EU Recovery and Resilience Mechanism) will contribute to fighting the effects of the health crisis and to developing European ecological transition policies, which are the European Green Deal and, in particular, the new and more ambitious European Adaptation Strategy. 30% of the total MFF and Next Generation EU expenditure will go to climate-related projects.

In line with the conclusions adopted by the European Council at its July 2020 meeting, Next Generation EU and MFF funds go hand in hand. Exceptional funds will be distributed in the form of grants and loans through MFF instruments and programmes,

ensuring homogeneity and consistency. Member States should develop their National Recovery and Resilience Plans, including a programme of reforms and investments that address the impacts of the health crisis and contribute to the ecological transition and the strengthening of economic and social resilience.

For its part, the conclusions of the Commission for Social and Economic Reconstruction, adopted by the Congress of Deputies, include the proposal to draw up and promote the implementation of a Green Recovery Plan articulated on the basis of the European financial instruments established for this purpose.

The objectives, priorities and lines of action in terms of climate change adaptation associated with both frameworks are closely linked:

European framework - Council conclusions	National Framework - Conclusions of the Commission for Social and Economic Reconstruction
National Recovery and Resilience Plans	Green Recovery Plan
MFF 2021 - 27 and Next Generation EU Resilience and Recovery Mechanisms	European financial instruments established for recovery
Priorities within Specific Objective 2 of the Cohesion Policy 2021 - 27: - Promote climate change adaptation, risk prevention and disaster resilience. - Promote efficient water management. - Promote biodiversity, green infrastructure in the urban environment and reduce pollution.	Economic reactivation - Block 2 Promote a just ecological transition and improve environmental quality, the main lines of action: - Meteorological monitoring and climate observation. - Preservation of the coastline. - Improve water resources. - Biodiversity conservation. - Study and support measures on the islands.

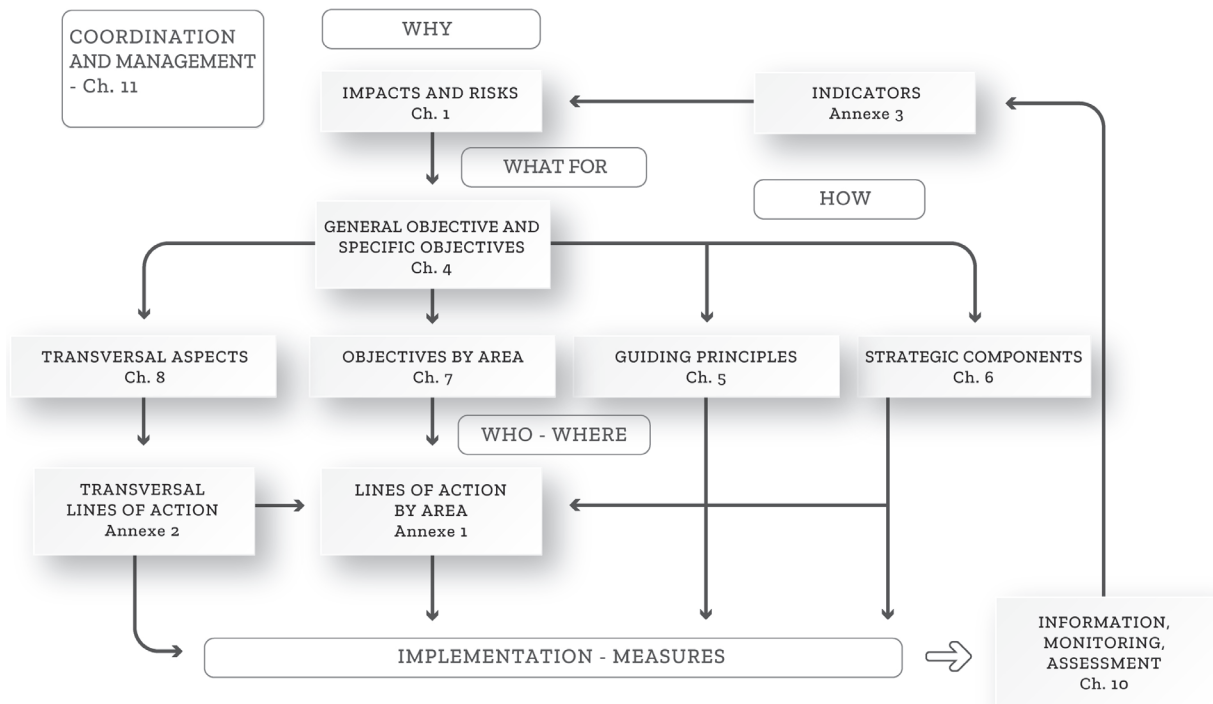
The National Climate Change Adaptation Plan 2021-2030 is the specific instrument for the planning and implementation of the national adaptation actions that respond to these European and national

conclusions. It is fully consistent with the priorities outlined in both and has the potential to make a significant contribution to addressing the effects of the health crisis and confronting the ecological transition.

EXECUTIVE SUMMARY

The National Climate Change Adaptation Plan 2021-2030 is the basic planning instrument for promoting coordinated and coherent action to tackle the effects of climate

change in Spain. Without prejudice to the competences that correspond to the different Public Administrations, the PNACC defines objectives, criteria, areas of work and lines of action to promote adaptation and resilience to climate change.



Structure of the PNACC 2021-2030. Relationships between the different parts of the document

The PNACC 2021 - 2030 is the result of a **collective process** of analysis and reflection (chapter 3). A process that began with the in-depth evaluation of the first PNACC and its three work programmes. This evaluation also drew from complementary sources, including the opinions, assessments and suggestions of people working in the field of adaptation in Spain, collected through surveys and in-depth interviews, and the analysis of the implementation of the actions set out in the first Plan and its programmes. The result was an evaluation report with 38 specific

recommendations for the definition of the new PNACC.

In a second phase, with a view to drafting the new Plan, the ideas and suggestions of experts and key actors in the field of adaptation were gathered using various formats: deliberative workshops, online forums and bilateral consultations with the main public administrations responsible for implementing adaptation policies and measures. In short, this new National Adaptation Plan is the result of analyses, assessments and

proposals from a wide range of people and organisations, both public and private.

The **general objective** of the PNACC 2021-2030 (chapter 4) is to promote coordinated and coherent action to address the effects of climate change in Spain in order to avoid or reduce present and future damage from climate change and to build a more resilient economy and society. To achieve this goal, 9 specific objectives to complement the general objective have been defined.

The PNACC sets out a number of **guiding principles** that will steer adaptation policies and measures (chapter 5). These include the consideration of social and territorial dimensions, the foundation on the best available science and understanding, transversality and integration in different fields of public management and institutional cooperation. In addition, it emphasises the need to consider a series of basic universal principles, such as respect for human rights and intergenerational justice.

The Plan also identifies **4 strategic components** (chapter 6) that facilitate the definition and development of effective adaptation initiatives: knowledge generation, integration of adaptation into sectoral plans, programmes and regulations, mobilisation of actors, monitoring and evaluation.

With the aim of facilitating the integration of adaptation actions in the different fields of public and private management, the PNACC defines 18 **areas of work**, specifying objectives for each of them (chapter 7). These areas of work include climate and climate scenarios; human health; water and water resources; natural heritage, biodiversity and protected areas; agriculture, livestock, fisheries, aquaculture and food; coasts and the marine environment; and forestry, desertification, hunting and inland fishing.

To these are added: the city, urban planning and building; cultural heritage; energy; mobility and transport; industry and services; tourism; the financial system and insurance activity; disaster risk reduction; research and innovation; education and society; and peace, security and social cohesion.

For each of the aforementioned areas of work, the Plan defines **lines of action** that specify the work to be carried out in order to achieve the objectives (see annexe 1). The lines of action are presented in the form of fact sheets that include a justification for the interest and a brief description of the orientation. Some of the main departments of the administration responsible for or collaborating in their development are identified and indicators are defined, which will later facilitate the evaluation of the degree of compliance with the defined lines of action.

As a complement to the sectoral action, the PNACC defines 7 **transversal aspects** (chapter 8), which must be promoted in the different areas of work: the deepening in the geographical and social components of vulnerability to climate change; the analysis of cross-border effects; the gender perspective; the prevention of maladaptation and perverse incentives; the analysis of the costs and benefits of action and inaction; and the orientation towards action. For the practical application of these seven transversal aspects, a number of other lines of action are defined, which are also included in the annexe to this plan.

Categories	Content	Examples
Guiding principles (chapter 5)	Fundamental and common aspects to all areas of work and their lines of action, which bring together the basic ethical principles, rights and approaches in order to guide decisions.	- Social and territorial equity - Human rights - Intergenerational justice - Scientific foundations - Ecosystem approach
Strategic components for action (chapter 6)	Identify the key instruments for achieving effective action in the area of adaptation.	- Knowledge generation - Integration into sectoral planning and programming - Mobilisation of actors - Monitoring and evaluation
Transversal aspects (chapter 8)	Defined with a purely operational function and translated into lines of action and initiatives that affect a broad set of areas of work.	- Social vulnerability - Gender mainstreaming - Cross-border effects - Prevention of maladaptation

Table 1. Guiding principles, strategic components for action and transversal aspects of the PNACC 2021-2030

The varied nature of climate change adaptation actions and the multiplicity of public management areas, administrative units and actors involved mean that the sources of **funding** for the lines of action contained in this Plan must also be diverse. Chapter 9 outlines the main instruments and lines of work aimed at strengthening the financing of adaptation, which include specific recovery measures within the Next Generation EU instrument and the European Union Multiannual Financial Framework 2021-27 (with the ERDF, EAGF, EAFRD and EMFF European funds, the LIFE Programme and Horizon Europe), national funds (PIMA ADAPTA and sectoral budgets) and private financing.

The PNACC significantly strengthens the instruments for information and monitoring of public adaptation policies and the Plan itself, including (chapter 10):

- **Reports on climate risks:** Global reports that synthesise and provide an up-to-date panorama of the understanding of the risks derived from climate change in Spain.
- **Sectoral adaptation reports:** Analyses of the status of any of the PNACC areas or sub-areas of work. These reports may be drawn up at the request of the

Government or the Congress of Deputies.

- **PNACC monitoring reports:** Freely-accessible, informative reviews of the actions carried out within the framework of the PNACC over a given period of time, as well as the conclusions, challenges and prospects for the future.

In addition, annexe 2 includes an initial set of indicators that should provide a dynamic overview of the effects of climate change and the progress achieved in adaptation, facilitating the continuous improvement of policies and measures. It also outlines the reinforcement of the Climate Change Adaptation Platform (AdapteCCa, in Spanish), created in 2013 under the PNACC framework, in order to consolidate its role as an access point to knowledge and to ensure its full functionality.

Adaptation to climate change requires coordinated and coherent action by Spanish society as a whole and, as such, it requires a system of governance that favours the participation of all actors involved, as well as detailed and action-oriented planning. To organise adaptation **planning** and **programming**, the PNACC defines two basic instruments (chapter 11):

- **Work programmes:** These detail the measures planned, within a specific temporal framework, in order to develop the lines of action defined in the PNACC and identify, where appropriate, priority measures, taking into account the level of risk associated with the different impacts of climate change, as well as the potential benefits of the proposed adaptation measures.

- **Sectoral and territorial plans:** These are instruments for the detailed planning of adaptation in specific areas of work or territories. These plans include a diagnosis of the main risks outlined in the area in question, the definition of objectives that respond to those risks and a set of measures to meet the objectives.

The coordination of the PNACC 2021-2030 is the responsibility of the Spanish Climate Change Office (OECC, in Spanish), part of the Ministry for the Ecological Transition and the Demographic Challenge, but its definition, development and evaluation is a collective task. In order to facilitate the **coordination, advice and participation** in adaptation matters, the PNACC provides for several specific, permanent forums:

- **Impacts and Adaptation Working Group (GTIA, in Spanish):** The technical exchange forum that brings together departments of the Central Administration and the Autonomous Communities with the general objective of coordinating and integrating the different strategies and plans for climate change adaptation being developed at national and regional level in Spain.
- **Impacts, Risks and Adaptation Committee (CIRA, in Spanish):** Newly created, this committee will bring together people from the academic sector, non-governmental organisations, public management and businesses, particularly SMEs, with the aim of providing ideas and recommendations for the advancement of the PNACC and contributing expert opinions on adaptation in Spain.
- **PNACC Seminars:** Meeting spaces to facilitate the treatment, in a monographic manner, of topics that are considered relevant at any given time for the development of the PNACC and its corresponding work programmes.

STRUCTURE OF THE DOCUMENT

This document is organised in two distinct parts:

- a - Text of the Plan:** Defines the structure, including the objectives, guiding principles, strategic components, areas work, funding, information, monitoring and evaluation mechanisms, and management structure and coordination.
- b - Annexes: lines of action and monitoring indicators:** The annexes describe,

in the form of fact sheets, the lines of action for the 18 established areas of work, as well as a series of complementary lines of a transversal character. The lines of action establish the framework within which the measures will be implemented, which will take the form of work programmes and sectoral or territorial programmes. They also contain a set of indicators that will be regularly updated to monitor the impacts and vulnerability to climate change.



THE

ADAPTATION

SCENARIO

1. CLIMATE CHANGE IN SPAIN: IMPACTS AND RISKS

1.1. AN UNEQUIVOCAL REALITY

Climate change is an unequivocal reality in Spain, confirmed by a wide range of observations. Among the features that characterise the change already observed in our country, the following are of note:

Increase in temperatures: The average temperature in Spain has increased by around 1.7 °C since pre-industrial times⁵. The Hawkins diagram (fig. 1) shows the evolution of average annual temperatures between 1901 and 2018, revealing an upward

trend, especially marked from the 1970s onwards. The rise in temperature is particularly intense during the last decade, which is consistent with the fact that the warmest years have mostly been recorded in the 21st century. In addition, a large portion of historical maximum temperature extremes are concentrated in the last decade.



Figure 1. Annual mean temperatures for Spain for the period 1901-2018. The gradation from blue to red indicates the temperature increase. (Data: Berkeley Earth, Source: <https://showyourstripes.info/>)

Longer summers: The rise in temperature has been particularly significant in the summer. In addition, according to AEMET⁶ data, the summer has lengthened by an average of nine days per decade. Specifically, summers now are almost five weeks longer than at the beginning of the 1980s.

Increase in torrid nights: Torrid nights, defined as those with a minimum temperature equal to or above 25 °C, have increased tenfold since 1984 in the 10 most populated Spanish capitals; this increase in heat stress has affected a potential population of more than nine million people (around 20% of the population).

⁵ - AEMET (2019). *El calor como nueva normalidad*. Available at: http://www.aemet.es/es/noticias/2019/12/Rueda_prensa_invierno_2019

⁶ - AEMET (2019). *Efectos del cambio climático en España*. Available at: http://www.aemet.es/es/noticias/2019/03/Efectos_del_cambio_climatico_en_espanha

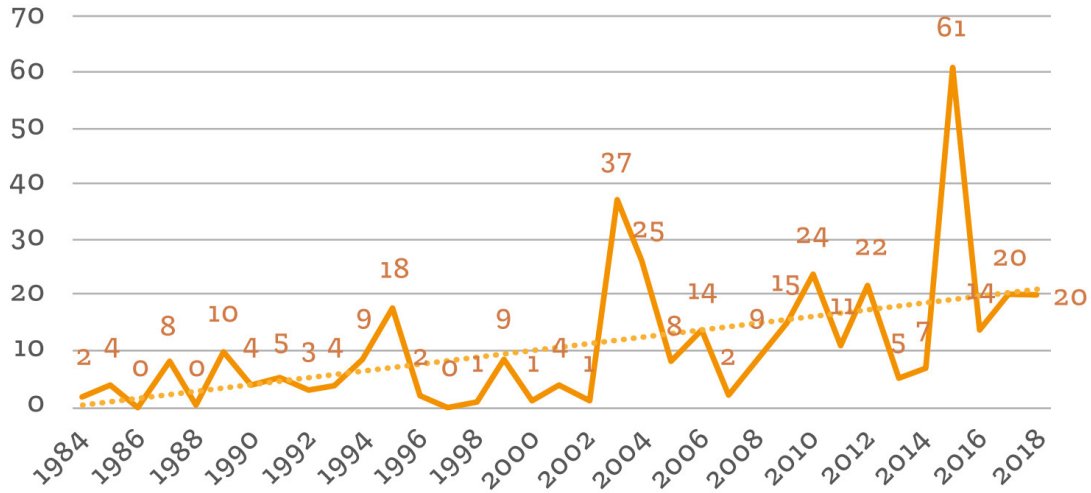


Figure 2. Evolution of the annual number of torrid nights since 1984 for the 10 most populated Spanish capitals. (Source: AEMET)

Increase in the number of heatwave days: According to data provided by AEMET, since 1984, the number of days per year exceeding the heatwave temperature thresholds in peninsular Spain has doubled, while cold episodes have been reduced by 25%. In addition, heatwaves recorded in June, when they have the greatest impact on health because the body is not yet acclimatised to the heat, are now 10 times more frequent than they were in the 1980s and 1990s of the 20th century.

Decrease in precipitation: The overall amount of precipitation has declined moderately, but significant changes are occurring in the annual distribution, with a trend towards earlier spring rains and less summer rainfall⁷.

Disappearance of glaciers: Spanish glaciers, present only in the Pyrenees, are undergoing a marked process of regression. They now occupy only 10% of the surface area they occupied at the beginning of the 20th century⁸.

Decrease in average river flow: The analysis of the evolution of the flow of Spanish rivers with a semi-natural regime shows that, in the period 1966-2005, there has been an average decrease in flow of -1.45% per year. For most rivers, the reductions are concentrated in spring and summer⁹.

Expansion of the semi-arid climate: comparing the Spanish climate maps for the period 1961-1990 and the period 1981-2010, AEMET calculates that, in peninsular Spain,

⁷ - Vicente-Serrano, S.M. et al. (2017). An updated review on recent trends in observational surface atmospheric variables and their extremes over Spain. *Cuadernos de Investigación Geográfica*, 43

⁸ - <https://www.miteco.gob.es/es/agua/temas/evaluacion-de-los-recursos-hidricos/ERHIN/glaciares-evolucion/>

⁹ - Martínez-Fernández, J. y otros (2013). Recent trends in rivers with near-natural flow regime: The case of the river headwaters in Spain. *Progress in Physical Geography* 37(5) 685–700

the territories with a semi-arid climate have increased by some 30,000 km², around 6% of Spain's surface area. The most affected areas are Castilla-La Mancha, the Ebro valley and the southeast of the peninsula.

Increase in marine water temperatures: Surface water temperature has risen in all Spanish marine regions. In the case of the Mediterranean, the increase has been 0.34 °C per decade since the early 1980s, according to daily records obtained by the Mediterranean Center for Environmental Studies (CEAM, in Spanish) between 1982 and 2019. The series of data obtained in L'Estartit (Girona) from 1974 onwards which in-

cludes records at different depths¹⁰, shows that the temperature is increasing significantly at all levels studied.

Rise in sea levels: Sea level rise has been particularly marked since 1993 in the area of the Strait of Gibraltar, the Canary Islands archipelago, as well as along the Atlantic coast. The mean rise in sea level on the Atlantic-Cantabrian coast follows the average global trend of 1.5 to 1.9 mm/year between 1900 and 2010, and 2.8 mm/year to 3.6 mm/year between 1993 and 2010. However, there is greater uncertainty regarding the mean sea level in the Mediterranean due to regional effects¹¹.

EMISSIONS SCENARIOS

Emissions scenarios are plausible representations of future greenhouse gas emission trends, capable of causing a change in the planetary energy balance (referred to as "radiative forcing"). The scenarios are based on a consistent and coherent set of assumptions about a number of key factors that determine the changes. It is important to note that the scenarios are not predictions, although they are useful for understanding the implications of particular economic development pathways and actions.

The IPCC Fifth Assessment Report defined four emission scenarios, called Representative Concentration Pathways (RCPs).

RCPs are identified by the total radiative forcing they would produce in the year 2100. RCP2.6 – the most moderate – would result in a forcing of 2.6 W/m² in 2100, while RCP 8.5 – the most intense in emissions – would result in a forcing of 8.5 W/m². The former would be compatible with a warming of 2 °C, and, therefore, with the first objective of the Paris Agreement, while the latter would produce a warming far short of the agreement. Between them, there are two intermediate scenarios: RCP4.5 and RCP6.0.

The IPCC Special Report on the Impacts of Global Warming of 1.5 °C provides scenarios related to a warming of 1.5 °C, in line with the higher ambition set out in the Paris Agreement.



¹⁰ - Data obtained at the Surface at 20, 50 and 80 m depths. More information: <https://www.meteo.cat/wpweb/climatologia/el-clima-ara/tendencia-climatica/tendencia-de-laigua-del-mar/>

¹¹ - Losada, I., Izaguirre, C. & Díaz, P. (2014). *Cambio climático en la costa española*. Oficina Española de Cambio Climático, Ministerio de Agricultura, Alimentación y Medio Ambiente. Madrid, 133 pág.

Acidification of marine water: The pH of marine waters has decreased by about 0.1 units over the last century, an acidification that has been more noticeable in surface waters, in contact with the atmosphere, than in deeper waters¹².

1.2. PROJECTED CHANGES

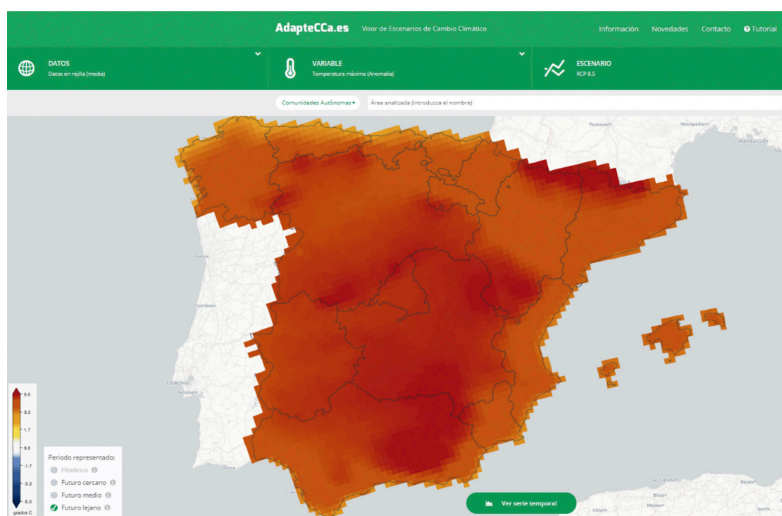
The regional projections for Spain, made on the basis of the climate models used in the IPCC's Fifth Assessment Report¹³, show future trends that essentially represent a deepening of the evolution already observed:

Increase in maximum and minimum temperatures: The increase is clear and progressive throughout the 21st century, higher in summer and for the highest emission climate change scenario. Maximum and minimum temperatures in summer and autumn

show a more intense increase than those in winter and spring, with greater warming in inland and eastern areas than in the north of the peninsula.

Greater number of warm days¹⁴: There is a progressive increase in the number of warm days throughout the 21st century for all scenarios analysed, both in mainland Spain and in the Balearic and Canary Islands. By the end of the 21st century, in mainland Spain, the proportion of warm days is expected to increase by almost 50% (with a range between 34% and 58%) for the highest emission scenario (RCP8.5), while for the stabilisation scenario RCP4.5, the increase will be around 24% (with a range between 14% and 31%).

Figure 3. Projected changes in maximum temperatures for the period 2071-2100, with respect to the period 1971-2000, for an RCP 8.5 scenario, as presented in the AdapteCCa climate change scenarios viewer (<http://escenarios.adaptecca.es/>)¹⁵



¹² - Kersting, D. (2016). *Cambio climático en el medio marino español: impactos, vulnerabilidad y adaptación*. Oficina Española de Cambio Climático, MAGRAMA, Madrid, 166 pág.

¹³ - Ambar, P., Casado, M.J., Pastor, A. Ramos, P. y Rodríguez Camino, E. (2017). *Guía de escenarios regionalizados del cambio climático sobre España a partir de los resultados del IPCC AR5*. Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente. Agencia Estatal de Meteorología, Madrid.

¹⁴ - A warm day is defined as a day on which the maximum temperature exceeds the 90th percentile of maximum temperatures for that day in the reference period, obtained from a 5-day window centred around that day.

¹⁵ - The data represented (data grid obtained from the Euro-CORDEX project) only cover mainland Spain and the Balearic Islands. The AdapteCCa platform also offers seasonal data, which include the Canary Islands.

Increase in the duration of heat waves:

The variations in this index do not have the same magnitude in all places in Spain. The smallest changes would occur in Galicia, communities of the Cantabrian coast and La Rioja, and the greatest changes in the communities of eastern Spain, such as the Region of Murcia, the Balearic Islands and, particularly, the Canary Islands.

Moderate decrease in precipitation:

Precipitation tends to decrease in most parts of Spain, with greater decreases in the SW quadrant of the Peninsula and the archipelagos.

Slight decrease in cloudiness: Cloudiness shows a slight decrease throughout the 21st century for the highest emission scenario, except in the north and the Mediterranean region in winter.

No change in extreme winds¹⁶: In general terms, no significant changes are projected in extreme winds over the Iberian Peninsula, except for a slight decrease in the 50-year return value in the northwest of the peninsula in summer in the medium (2041-2070) and long term (2071-2100).

Rise in mean sea level¹⁷: In the short term (2026-2045), the models project, in the upper band, relatively uniform values for the entire Spanish coast, between 17 and 25 cm depending on the scenario.

However, for the period 2081-2100, the differences between scenarios widen, in RCP4.5 (medium emissions) the models project increases in mean sea level in the upper band of between 55 cm and 70 cm with respect to the base period (1985-2005), with the highest values in the Canary Islands, the Balearic Islands and the western Cantabrian coast. For the RCP8.5 scenario, the upper band is projected to increase significantly, with values above 75 cm along the entire Spanish coast and especially high values in Galicia, the Balearic Islands (>80 cm) and the Canary Islands, where values are projected to increase by around 1 m.

Increase in sea water temperatures¹⁸:

Models indicate that seawater temperatures in the uppermost layer will continue to rise, with the largest increases projected towards the end of the century and for the highest emission scenarios (RCP 8.5). Increases are projected to be particularly high in the waters of the Balearic Islands, where increases of up to 4 °C in the mean values over the period (2081-2100) are projected compared to the base period (1985-2005). These increases in projections are associated with a higher probability of extreme temperatures and marine heat waves.

By entering data derived from climate change projections into hydrological models, the main water cycle trends identified are as follows:

¹⁶ - Herrera, S. (coord.) (2018). *Proyecciones regionales de Cambio Climático para vientos extremos en España para el s.XXI: Caracterización de valores de retorno y frecuencia de configuraciones atmosféricas de peligro*. Available at: https://www.adaptecca.es/sites/default/files/u50/2018_uc_proyecciones_regionales_cc_vientos_extremos.pdf

¹⁷ - Ramírez, M.; Menéndez, M.; Camus, P. y Losada, I. (2019). *Elaboración de la metodología y bases de datos para la proyección de impactos de cambio climático*

a lo largo de la costa española. Tarea 2: Proyecciones de alta resolución de variables marinas en la costa española. MITECO, 2019. Available at: https://www.adaptecca.es/sites/default/files/documentos/2019_metodologia_y_bbdd_proyeccion_impactos_de_cc_costa_espanola.pdf

¹⁸ - Data from high-resolution projections of marine variables along the aforementioned Spanish coastline (Ramírez et al., 2019).

- **Increase in evapotranspiration**¹⁹: Potential to occur across the whole of Spain, increasing in higher emissions scenarios and as the century progresses²⁰.
- **Decrease in average river flow**: The aforementioned Centre for Public Works Studies and Experimentation (CEDEX, in Spanish) study projects decreases for most basins, which are greater as the century progresses and in higher emissions scenarios²¹. The projections are more unfavourable in Andalusian basins and in the Balearic and Canary Islands.
- **Decrease in aquifer recharge**: A recent study carried out by the European Commission²² estimates that, for a global warming of 2 °C, the recharge of aquifers in Spain could be reduced by 3,272 hm³/year²³, which would be equivalent to 15% of the amount of water extracted annually from rivers and aquifers for irrigation purposes.
- **Increase in droughts**: Climate projections show a future in which droughts will be longer and more frequent, with this effect becoming more pronounced as the 21st century progresses. CEDEX

studies indicate that droughts of 2 years' duration will be more frequent (they will have a shorter return period for the same deficit) and the same applies to 5-year droughts.

- **Torrential rainfall and floods**: The reduction in mean annual rainfall is not necessarily linked to a reduction in extremes and, in fact, episodes of torrential rainfall and flooding are expected to increase in some areas²⁴. Due to the short duration of torrential rainfall, they do not favour the recharge of aquifers, reducing their regulating effect on the hydrological cycle.

1.3. IMPACTS AND RISKS ARISING FROM CLIMATE CHANGE

The climate change trends described above cause, in turn, a series of effects on Spanish ecological systems and economic sectors. The following are of note:

- **Reduction in water resources**: Changes in the natural water cycle affect the quantity and quality of available water resources, with implications

¹⁹ - Evapotranspiration is defined as the moisture loss from the combination of direct evaporation and the loss produced by the transpiration of vegetation.

²⁰ - CEDEX (2017). Evaluación del impacto del cambio climático en los recursos hídricos y sequías en España. Available at: https://www.miteco.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/evaluacion_cc_recursos_hidricos_sequias_espana_tcm30-437706.pdf

²¹ - For the end of the century and the RCP8.5 scenario, the projected global reduction is 24%.

²² - Bisselink, B. et al. (2018). *Impact of a changing climate, land use, and water usage on Europe's water resources*, EUR 29130 EN, Publications Office of the European Union, Luxembourg.

²³ - The change is estimated with respect to the reference period 1981-2010.

²⁴ - MITECO (2018). *Incorporación del cambio climático en la evaluación preliminar del riesgo de inundación (EPRI) en el segundo ciclo de aplicación de la Directiva de Inundaciones (2007/60/ce)*. Metodología general. Ministerio para la Transición Ecológica. Available at: https://www.miteco.gob.es/es/agua/temas/gestion-de-los-riesgos-de-inundacion/cambio-climatico-en-la-epri-metodologia-general_tcm30-485704.pdf

for agriculture and livestock, urban supply, hydroelectric production and ecosystems, particularly affecting, in the latter case, ecological processes, species and habitats linked to aquatic ecosystems.

- **Impacts on fauna and flora and other elements of natural heritage:** Local changes in climate translate into demographic, phenological and behavioural changes in wild species, which, in turn, affect the interactions between them, including uncoupling in the biological rhythms of interdependent species. Climate change also produces changes in external geodynamic processes, which can directly affect elements of geological heritage.
- **Changes in the distribution of land and aquatic species:** Climate change causes a shift in the distribution of species to habitats with a more favourable climate. This occurs for land animal and plant species and for those in inland or marine waters. In the latter, the displacement of species at the base of the food chains also means a displacement of the species that feed on them.
- **Expansion of invasive alien species:** Climate change also allows for the potential colonisation of our territory by invasive alien species or the expansion of the distribution area of those already present. These changes include, for example, the increase in the distribution areas of species that

act as vectors of disease transmission.

Alien species can also displace native species, threatening their stability.

- **Deterioration of ecosystems:** The aforementioned changes lead to a loss of diversity and resilience of ecosystems (see figure 4), resulting in a decline in the contribution of nature to human well-being through its ecosystem services. These include regulating services (pollination, climate regulation, regulation of air quality and water quantity and quality, protection against hazards and soil formation), material goods (food, energy, raw materials and medicinal resources) and non-material goods (learning and inspiration, psychological well-being and identity).
- **Increased risk of wildfires:** Aspects such as drier soil and higher temperatures increase the risk of forest wildfires, making conditions conducive to large wildfires more frequent.
- **Increased risk of desertification:** A study carried out within the PNACC framework analysed the impact of climate change on the risk of desertification in Spain²⁵. Considering the combined effects of the evolution of aridity and erosion, the study revealed that, by the end of this century, the area at risk of desertification would increase for all the established categories, with the greatest projected change being in the very high (+45%) and high risk (+82%) categories²⁶.

²⁵ - MAGRAMA (2016). *Impactos del cambio climático en los procesos de desertificación en España*.

²⁶ - Percentage change in relation to the control period: 1971-2000.

- **Impacts on human health:** Climate change affects the health of the Spanish population through its direct effects – heat waves²⁷ and other extreme events, such as floods and droughts – but also through indirect effects (increase in atmospheric pollution²⁸ and aeroallergens, change in the distribution of dis-

ease-transmitting vectors²⁹, loss of water and food quality). In the case of the Canary Islands, the possible eastward displacement of the Azores anticyclone would weaken the trade winds, favouring the arrival of African winds and the advection of Saharan dust³⁰.

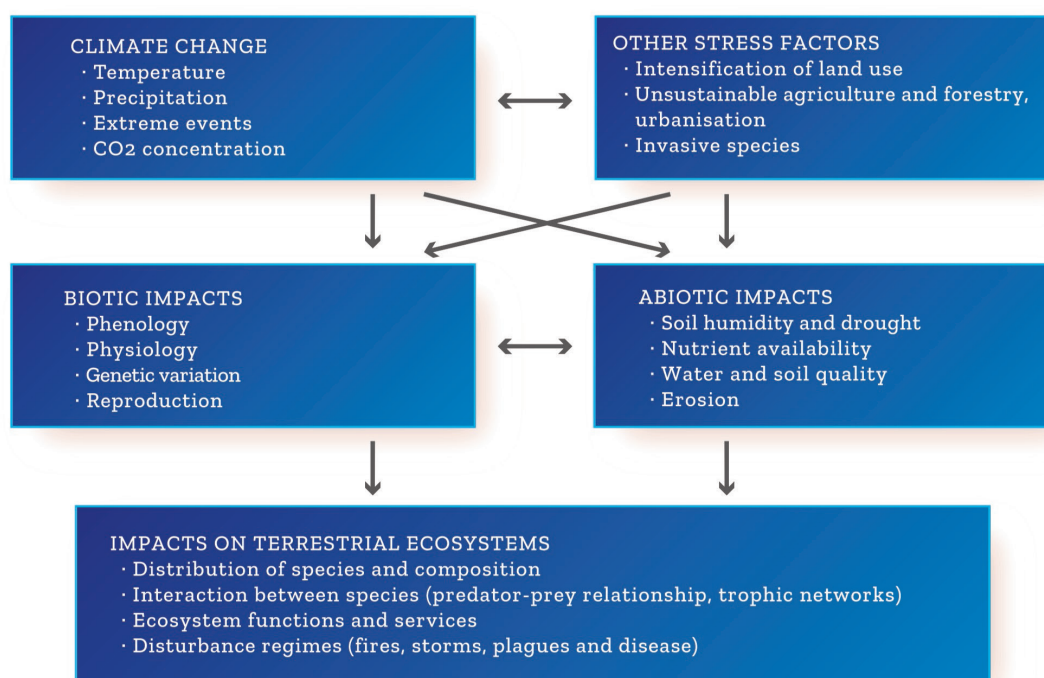


Figure 4. Panorama of the impacts of climate change on terrestrial ecosystems.
Source: European Environment Agency (2017). Climate change, impacts and vulnerability in Europe. An indicator-based report, EEA report 1/2017

27 - In Spain, an estimated 1,300 deaths per year are attributable to excessively high temperatures.

28 - Climate strongly influences the spatial and temporal distribution of air pollutants through winds, vertical mixing and precipitation. Climate change may favour the persistence of stable atmospheric conditions that hinder the dispersion of primary pollutants in urban areas, aggravating air pollution, especially concentrations of nitrogen oxides and particulates. Furthermore, concentrations of ozone and PM_{2.5} precursors increase faster in brighter light and at higher ambient temperatures, so climate change tends to increase them.

29 - According to data from the Ministry of Health, in 2016, 749 cases of malaria, 297 of Zika, 195 of Dengue, 4 of West Nile fever and 6 of tick-borne relapsing fever, among other diseases, were confirmed in Spain.

30 - Martín Esquivel, J. L. et al. (2013). Evaluación preliminar de la vulnerabilidad ante el cambio climático en las Islas Canarias. Viceconsejería de Medio Ambiente, Consejería de Educación Universidades y Sostenibilidad, Gobierno de Canarias. Santa Cruz de Tenerife, 95 pp. Available at: https://www.adaptteca.es/sites/default/files/documentos/20130614_estudio_preliminar_vulnerabilidad_final.pdf

Despite the trend towards higher temperatures, mortality attributable to heat waves in Spain has undergone a significant decline in the period 2004-2013 compared to the previous two decades. The impact of the heat wave in the summer of 2003 and the implementation, in the following year, of the National Plan of Preventive Actions for the Effects of Excess Temperatures on Health could have acted as a catalyst for this change in trend³¹.

On the other hand, the COVID-19 pandemic has raised awareness of the close interrelationships between environmental transformation and the emergence of new diseases³². The World Health Organisation has been warning for some time that climate change may facilitate the emergence of new epidemic diseases or increase their transmission³³, highlighting the need to address threats to human health that are not yet precisely known.

- Impacts on the agricultural sector:

Agriculture, livestock and forestry are sectors closely dependent on climate and soil. The impact of climate change varies according to factors such as geographical location and sub-sector (type of crop or livestock). However, in general, the increase in temperature will increase water stress, decreasing the production of some crops. In addition, changes in

seasonality and climate variability will have a significant effect on yields and, foreseeably, on the quality of agricultural, livestock and forestry products. Soil degradation and desertification will limit the space potentially suitable for certain crops. Also, a higher potential impact of extreme weather events is expected, which will be more frequent and virulent. This is coupled with a greater occurrence of extreme phenomena and the emergence of new pests and diseases in both crops and animals.

Excessive heat has an impact on animal welfare, with negative repercussions on production. In some areas, loss of pasture productivity is another factor that may have a negative impact on livestock utilisation.

Finally, it should be noted that the alterations resulting from climate change also affect fish, shellfish and aquaculture resources.

- Impacts on tourism: Climate change affects the tourism sector through three complementary channels: the impact on certain key resources that support the sector (elements such as snow or coastal sand are key resources in snow and sun and beach tourism, respectively), the impact on tourism infrastructure (for example, those located along the coastline,

³¹ - Diaz, J. et al. (2018). Time trend in the impact of heat waves on daily mortality in Spain for a period of over thirty years (1983–2013). *Environment International* 116: 10–17

³² - UNEP Statement on Covid-19 <https://www.unenvironment.org/news-and-stories/statement/unep-statement-covid-19>

³³ - Patz, J.A. (2003). Climate change and infectious diseases. In: *Climate change and human health - risks and responses*. World Health Organization.

such as seafront promenades) and impacts on tourism demand itself (for example, excessive summer heat limits demand for urban tourism in areas subject to high summer temperatures). On the other hand, better conditions in countries of origin may lead to reductions in destination demand, which is important for Spain, as a major recipient of international tourism.

- Loss of coastal resources: Sea level rise and the increased destructive power of coastal storms produce diverse impacts on the coastline, including shoreline retreat and changes in the sediment and erosion regime, with effects on coastal ecosystems such as sand flats, deltas and estuaries, but also on infrastructure and the built environment.

- Changes in energy production and consumption: Climate change and climate variability have impacts on different components of the energy system, affecting energy resources (for example, changes in the availability of wind, sun or water), the generation, transport, distribution and storage of energy, as well

as consumption patterns. In the latter, changes include a reduction in consumption associated with heating, but an increase in consumption associated with cooling³⁴, with an estimated 14% increase in cooling degree days per decade in the period 2010-2049³⁵.

- Loss of functionality of transport infrastructures: The vulnerability of infrastructures to current and future climate-related adversities is diverse. For example, a questionnaire sent to all state-owned port authorities identified wind and waves as the climate-related variables that have the greatest impact on port operations, capable of paralyzing activity in most ports³⁶. On the other hand, a study carried out by CEDEX has identified the sections of the State Road Network and the General Interest Railway Network that are potentially most exposed, identifying the types of events that most frequently affect the different sections of the network and their repercussions on users and infrastructure³⁷.

- Social changes: Climate change has an impact on the specific features of social

³⁴ - Cooling degree day is a unit of measurement designed to quantify the energy demand required for cooling buildings. It is usually defined as the number of degrees above 18 °C of the average daily temperature.

³⁵ - Girardi, G. et al. (2015). Informe de adaptación al cambio climático del sector energético español. Instituto de Investigación Tecnológica. Univ. Comillas. https://www.miteco.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/informeadaptacionalccdelsectorenergeticoespanol-2015_tcm30-485922.pdf

³⁶ - Gomis, D. y Álvarez, E. (coords.) (2016). Vulnerabilidad de los puertos españoles ante el cambio climático. Ministerio de Fomento, Madrid.

³⁷ - Compte, A. (2018). *Secciones de la red estatal de infraestructuras de transporte terrestre potencialmente más expuestas por razón de la variabilidad y cambio climáticos*. CEDEX, Madrid.

systems, both in terms of the implications of its direct impacts and the consequences of the adaptation measures applied to deal with them. These impacts are related to aspects such as the economy and work, culture, heritage and identity values, governance, population distribution in the territory, social cohesion, conflicts associated with the use of natural resources³⁸, social inequality, including gender inequality, and other aspects of a social nature.

- **Impacts on cultural heritage:** Some of the effects of climate change on cultural heritage are already visible: many buildings located near the coast are affected by rising sea levels – coastal batteries, fortifications, industrial fishing complexes –; fluctuations in the water table affect the structural stability of buildings of historical-cultural interest and the increase in temperature together with the effects of atmospheric pollution lead to an increase in physical, chemical and mechanical erosion processes. Furthermore, considering cultural assets in all their dimensions, the alterations in cultural landscapes, practices, knowledge and rituals associated with agricultural economic activities and traditional ways of life as a result of increased desertification, floods and extreme events cannot be forgotten.

Looking ahead, in general, the potential impacts of climate change will be more severe in the higher emissions scenarios and as the 21st century progresses.

ADAPTATION AND UNCERTAINTY

For centuries, human communities have looked to the past to make predictions about the future. This ability to project what is to come has allowed us to thrive, by anticipating different threats and constraints. However, this predictive ability, based on experience, is beginning to decline as we move towards a climate we do not know.

More uncertainty means less precision in the knowledge of what will happen in the future, which makes it more difficult to prevent and anticipate or, if you like, to produce “precise” responses for the future. Consequently, uncertainty translates into more risks. By way of example:

- Various agricultural sub-sectors, especially dryland farming, are facing increasing difficulties in predicting seasonal weather patterns, which makes it difficult to make appropriate decisions about the work to be carried out or its timing. Seasonal and medium-term weather forecasting can become a much-needed tool.
- Changes in patterns in phenomena such as heavy rainfall cause damage to agricultural crops, but also to urban areas and infrastructures outside the periods that have been habitual until now.

On the other hand, it should be noted that climate change often interacts with

³⁸ - Presidencia del Gobierno (2017). Estrategia de Seguridad Nacional 2017.

other non-climatic stress factors, multiplying the pressures on ecological, social and economic systems. A good example is found in rural areas, with the interaction between depopulation processes and the effects of climate change (see thematic box).

ECONOMIC ASSESSMENT OF THE IMPACTS

The range of impacts arising from climate change is very broad, affecting essential sectors of the economic system. For this reason, their quantification has only been partially addressed, often through comparative studies.

According to the recent European Commission report, *Climate change impacts and adaptation in Europe (JRC, PESETA IV)*³⁹, the benefits of adaptation measures are long-lasting, yet the damage from inaction grows over time and with the increase in global warming. According to the report, if a global warming of 3°C were to occur, the annual welfare loss in the EU as a whole

could represent 1.4% of GDP, considering a limited set of climate impacts (river flooding, coastal flooding, agriculture, droughts, energy supply, mortality from temperature extremes, and windstorms).

Furthermore, in this context, welfare losses in economic terms due to climate impacts, monetised in the PESETA IV report, show a clear north-south divide, with welfare losses in southern regions several times higher than in northern Europe. The following graph shows the data obtained in the aforementioned study with the aggregated economic impact – measured in terms of GDP – for Europe as a whole and for each of the five geographical regions taken into account for warming scenarios of 1,5 °C, 2 °C and 3°C. The study concludes that southern Europe is the most impacted region in the 1.5°C and 2°C scenarios and the second most economically impacted in the 3°C scenario.

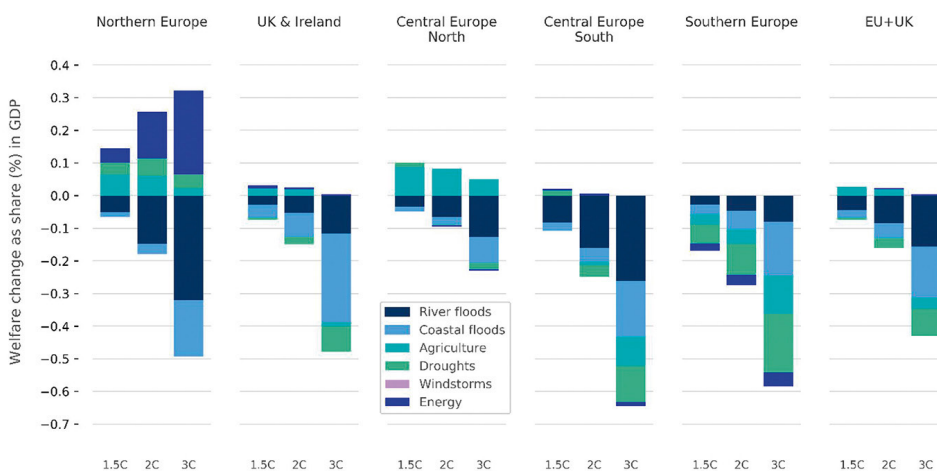


Figura 5. Estimated welfare loss (expressed in % of GDP) for a set of impacts arising from climate change (river and coastal flooding, agriculture, droughts, extreme winds and changes in energy production). Estimates are presented for five European geographical regions and for three possible global warming levels (1.5 °C, 2 °C and 3 °C).

Fuente: Final report of the Peseta IV project (JRC, 2020).

³⁹ - Climate change impacts and adaptation in Europe: JRC Peseta IV Final Report. https://ec.europa.eu/jrc/sites/jrcsh/files/pesetaiv_summary_final_report.pdf

According to estimates by the European Environment Agency, weather and climate-related extremes alone have caused direct economic losses in Spain in excess of €37 billion since 1980⁴⁰.

Modelling the impacts of climate change facilitates the understanding of processes through which climate change affects the economy. However, it is necessary to be aware that models only incorporate part of the potential costs of climate change. As the OECD⁴¹ points out, the models, even the most sophisticated, only consider a subset of the risks and opportunities posed by climate change. One of the challenges identified by the organisation is the consideration of changes that are both new and potentially catastrophic, and which are often not integrated into the results due to limited evidence.

From a sectoral perspective, there are also important gaps in knowledge, which are partly explained by the difficulties in modelling certain risks. The OECD identifies impacts on biodiversity and ecosystem

services or those affecting business and industry as among these poorly assessed areas. Also, from a transversal perspective, it is necessary to assess and address the impacts on non-remunerated contributions in the domestic and care setting.

In order to help address some of these limitations, this Plan dedicates a specific line of action to the "Development of Methodologies and Tools for the Estimation of Climate Change Risks and Informed Decision-Making for Adaptation" (line 16.4).

These limitations make it difficult to incorporate climate risks and adaptation into macroeconomic policies and their forecasting, although some international organisations are already working in this direction. However, much more rapid progress is being made in analysing the economic, social and environmental costs and benefits of adaptive responses, which is very useful for decision-making and is the subject of one of the seven transversal lines of action in the Plan (line T.6 "Costs and Benefits of Adaptation and Inaction").

⁴⁰ - EEA (2019). Economic losses from climate-related extremes in Europe. Available at: <https://www.eea.europa.eu/data-and-maps/indicators/direct-losses-from-weather-disasters-3/assessment-2>

⁴¹ - OECD. Adapting to the impacts of climate change. Available at: <https://www.oecd.org/env/cc/Adapting-to-the-impacts-of-climate-change-2015-Policy-Perspectives-27.10.15%20WEB.pdf>

TERRITORIAL IMBALANCE, DEPOPULATION AND ADAPTATION TO CLIMATE CHANGE

The depopulation affecting inland Spain is a phenomenon that has various demographic causes but, above all, is related to the trend towards the concentration of population and economic activity in large urban areas. The so-called "Demographic Challenge" is a multidimensional phenomenon (comprising depopulation, ageing and the floating population) that has effects at both a national and international level. Although its causes are varied, they are closely related to economic activity, territorial organisation models and population mobility. As such, although demographic challenges affect the whole of Spain, their interaction with other socio-economic phenomena is more pronounced in inland areas.

The movement of population from rural areas to cities, which has been taking place for decades, has led to markedly negative population trends in smaller municipalities, threatening the disappearance of entire villages. According to the General Guidelines of the National Strategy to Address the Demographic Challenge, almost 50% of Spanish municipalities are at risk of depopulation, and this risk is greater in small municipalities and in sparsely populated rural areas. On the other hand, the displacement of the population towards urban areas (in which more than 80% of the population already live, as shown in the Spanish Urban Agenda) leads to a significant increase in pressure on environmental quality in cities. The knowledge, practices and technologies that rural communities have applied in their environments have contributed to the conservation of certain natural systems and the maintenance of their associated benefits (environmental services). Therefore, a large part of the agricultural and forestry areas of high natural value in Spain are humanised systems, moulded by the communities according to their needs and conserved to the present day. The practical knowledge that has made this possible has been shaped by centuries of dynamic adaptation to the environment and, therefore, has enormous potential for tackling climate change, where sustainability is the key factor. The depopulation and ageing of the population

is leading to the abandonment and degradation of these systems, increased risk (for example, of forest wildfires) and loss of adaptation options.

Moreover, rural livelihoods are highly dependent on climate-sensitive resources, such as water or land, which provide basic support for their well-being, and are a source of material assets and a capital for the diversification of sources of income. Climate change is already having repercussions on nature and its resources, and this is having a particular impact on rural areas.

The restoration and conservation of ecological infrastructure and other ecosystem-based approaches can contribute to promoting sustainable land planning, generating green sources of income and employment and, at the same time, enhance climate change mitigation and the adaptation to its effects. Rural societies, through the maintenance of ecosystems and green infrastructure (forests/woodlands, riverbank vegetation, etc.), allow the continuity of environmental services of general interest, which should be correctly valued and compensated through instruments such as the payment for environmental services provided for in the Common Agricultural Policy. On the other hand, the diversity of production systems minimises risks in the face of increasing climate variability, therefore, the solution to demographic challenges depends to a large extent on rural economies being able to diversify, integrating sectors other than agriculture.

Climate change adaptation strategies based on rural spatial planning should incorporate a broad vision of the demographic factor and its connection with urban areas. Promoting integrative, inclusive and strategic governance or adaptive approaches, such as learning from experience, monitoring and feedback, can contribute to better management of the uncertainties and difficulties associated with the social and environmental changes that are the context of the demographic challenge and the rural environment.

2. CLIMATE CHANGE ADAPTATION POLICIES

2.1. PRELIMINARY CONCEPTS

THE COMPONENTS OF RISK

Risks from climate change can be conceptualised in various ways. This National Plan assumes the framework set out in the IPCC Fifth Assessment Report (figure 6), which defines risk as the result of the interaction of the **hazards** arising from climate change with the **vulnerability** and **exposure** of human and natural systems to these hazards. Changes in the climate system (left) and socio-economic processes (right) are drivers of the different components of risk.

the figure can be applied to the risk of wild-fire, coastal flood, the health impacts of extreme temperatures, etc.

This diagram facilitates the identification of different strategies to avoid or limit risk: act to reduce the hazard, reduce exposure or reduce vulnerability.

It is important to note that risk cannot only be analysed in global terms alone; it is often assessed in relation to a particular impact or set of impacts. Thus, the diagram in

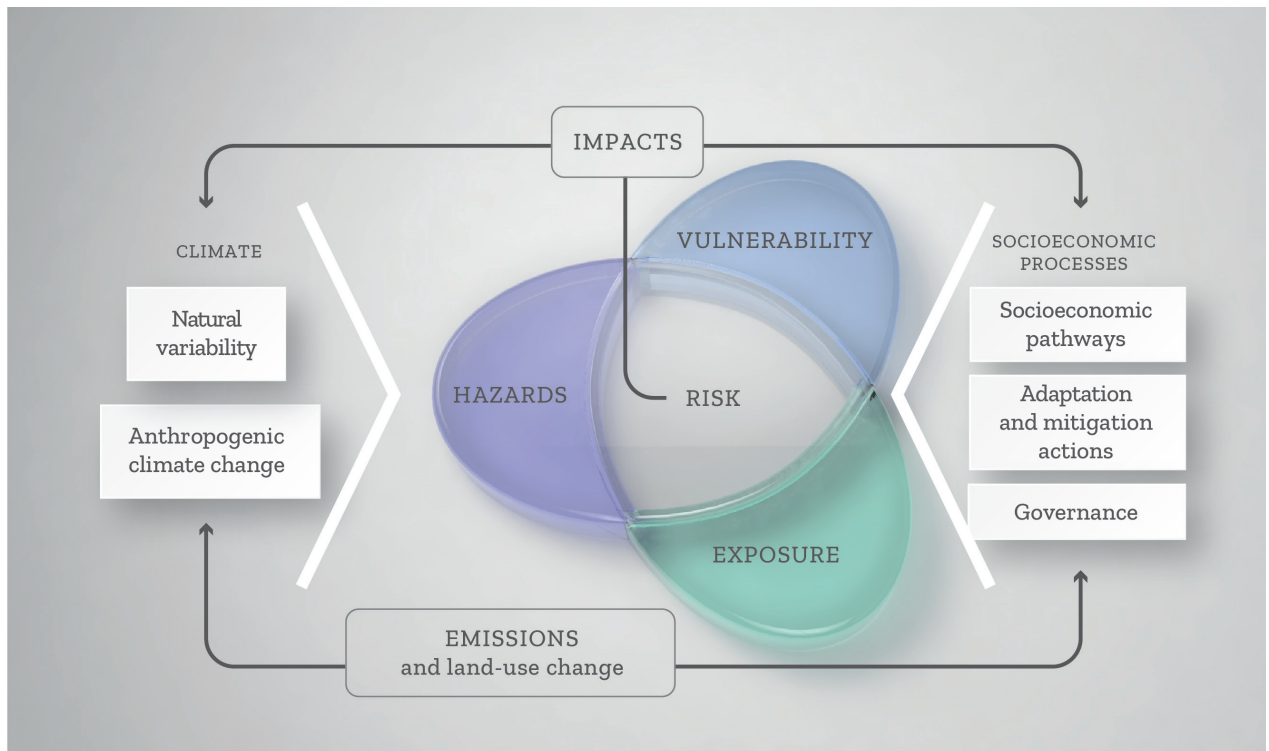


Figure 6. Components defining climate change risk.

Source: IPCC (2014). Fifth Assessment Report. Group II. Summary for policymakers: Fig.1

PROGRESSIVE ADAPTATION AND TRANSFORMATIONAL ADAPTATION

Adaptive capacity has limits, which is why it must be approached from different perspectives. On the one hand, it is necessary to implement progressive adjustments in the affected areas (progressive adaptation) to cope with smaller climate change impacts or those that occur gradually over time. However, for more sudden or larger impacts, for which progressive adaptation may be overwhelmed, and in order to achieve long-term sustainability, adaptation responses may involve more profound transformations in our socio-economic and natural systems (transformational adaptation). Mechanisms must also be put in place to cope with the unavoidable losses and damages caused by climate change, taking into account both economic losses and damages as well as those of a social or ecological nature.

2.2. INTERNATIONAL COMMITMENTS

The PNACC 2021-2030 contributes to the fulfilment of various international commitments made by Spain over the last decade. We highlight:

The United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement:

UNFCCC: Adaptation to climate change is an essential element of the Convention's work agenda. The key objective is to develop an international cooperative framework that enables all countries to address the risks posed by climate change and promotes cooperation. Article 4.1(b) of the UNFCCC requires Parties to "*formulate, implement,*

publish and regularly update national and, where appropriate, regional programmes containing (...) measures to facilitate adequate adaptation to climate change". The PNACC 2021-2030 and its Work Programmes will provide the framework for the implementation of this commitment.

The Paris Agreement: The Paris Agreement (2015) establishes among its basic objectives (Article 2.1.b) "increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development (...)". To this end, the Parties recognise the need for adaptation action to be gender-responsive, participatory and transparent, to take into account the most vulnerable groups, communities and ecosystems, and to be based on the best available science (Art. 7.5). These issues have been addressed in the guiding principles of the plan and its transversal aspects, which address, among other issues, the treatment of social and territorial vulnerability, the gender perspective for a fairer and more inclusive society, and the need to establish transparent reporting mechanisms on impacts, vulnerability and adaptation policies and measures.

Convention on Biological Diversity (CDB): This convention pays increasing attention to the interrelations between biodiversity and climate change, which is expressed in a wide range of decisions adopted at the Conferences of the Parties⁴². Among the issues addressed are

⁴² - Decision VII/15 (COP 7), Decision VIII/30 (COP 8), Decision IX/19 (COP9), Decisions XI/19, XI/20 and XI/21 (COP 11) and Decision XII/20 (COP 12)

the search for synergies between biodiversity conservation and climate change adaptation and mitigation actions, the integration of the biodiversity component in climate change responses, and the relationship between climate change, biodiversity and disaster risk reduction. In order to achieve synergistic adaptation with biodiversity conservation, this plan includes the ecosystem approach and the search for nature-based solutions among its guiding principles (section 5.3).

United Nations Convention to Combat Desertification (UNCCD): Desertification and land degradation are both a cause and a consequence of climate change. The UNCCD, as the only multi-lateral agreement on land and soil, has the capacity to make a significant contribution to combating climate change through land management, rehabilitation and restoration of degraded land.

Through the Joint Liaison Group established in 1991, the three Rio Conventions (UNFCCC, CBD and UNCCD) work together to enhance synergies, coordination and cooperation between them, linking climate change adaptation and biodiversity with conservation and the sustainable use of resources. The Rio Conventions have the potential to act as catalysts for adaptation in a synergistic manner, thereby enhancing the impact of individual measures.

The PNACC incorporates a specific line of action "Forestry, desertification, hunting and inland fisheries", which

will work on the prevention of desertification and land degradation and the promotion of adaptive restoration of degraded land.

The Sendai Framework for Disaster Risk Reduction (2015-2030): This agreement⁴³, adopted in 2015 at the Third UN World Conference on Disaster Risk Reduction, commits signatory parties to reduce disaster risk and build resilience. Climate change is explicitly recognised as one of the drivers of disaster risk.

"Disaster risk reduction" is another area of work in the plan, which will promote the prospective assessment of disaster risks, taking into account climate change projections and scenarios.

As stated in the guiding principles of the Sendai Framework, paragraph 19 d), risk reduction also requires the empowerment of the people most affected by disasters, integrating gender and age perspectives, among others, as well as the leadership of women and youth.

The 2030 Agenda for Sustainable Development: In 2015, the General Assembly of the United Nations adopted the 2030 Agenda for Sustainable Development, defined as "a plan of action for people, planet and prosperity, which also seeks to strengthen universal peace and access to justice". The Agenda defines 17 Sustainable Development Goals.

Six SDGs are closely related to climate change and the environment, and five others are affected by the impacts

43 - https://www.unisdr.org/files/43291_sendai-frameworkfordrren.pdf

that global change is having on the most vulnerable areas of the planet. However, the PNACC is closely linked to Goal 13 "Climate Action", which aims to take urgent action on climate change. The plan will have a particular impact on the achievement of some of its goals, such as:

- Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.
- Integrate climate change measures into national policies, strategies and planning.
- Improve education, awareness-raising and human and institutional capacity on climate change adaptation, impact reduction and early warning.

2.3. EUROPEAN ADAPTATION POLICY

The EU Adaptation Strategy

With the aim of forging a more climate-resilient Europe, in 2013, the European Commission adopted the European Union Strategy on Adaptation to Climate Change⁴⁴. The three core objectives set out in the Strategy were to encourage action by Member States, facilitate more informed decision-making and promote adaptation in key vulnerable sectors.

The Strategy identified eight actions to achieve these objectives:

- Encourage all Member States to adopt comprehensive adaptation strategies.
- Provide LIFE funding to support capacity creation and step up adaptation action in Europe (2013-2020).
- Introduce adaptation in the framework of the Covenant of Mayors for Climate and Energy.
- Bridge the knowledge gap.
- Further develop Climate-ADAPT as the one stop shop for adaptation information in Europe.
- Facilitate the climate proofing of the Common Agricultural Policy (CAP), the Cohesion Policy and the Common Fisheries Policy (CFP).
- Ensure more resilient infrastructures.
- Promote insurance and other financial products for resilient investment and business decisions.

In 2018, the European Adaptation Strategy was the subject of a detailed evaluation⁴⁶, which concluded that, overall, the Strategy has met its objectives and progress has been made in each of the eight actions outlined, highlighting:

- Between 2013 and 2018, the number of Member States with a national adaptation strategy increased from 15 to 25.
- The EU has promoted and monitored adaptation measures through LIFE projects and the Covenant of Mayors for Climate and Energy⁴⁷.

⁴⁴ - COM (2013) 216 final

⁴⁵ - <https://climate-adapt.eea.europa.eu/>

⁴⁶ - COM (2018) 738 final: Report from the Commission to the European Parliament and the Council on the implementation of the EU Strategy on adaptation to climate change.

- The Strategy has contributed to improving adaptation knowledge and sharing that knowledge for informed decision-making.

- Through the Strategy, adaptation has permeated and guided a wide range of key EU policies and funding programmes and reinforced links with disaster risk reduction, infrastructure resilience and the financial sector.

Looking ahead, the evaluation raises some relevant issues:

- The need for the EU to consider climate-security links and cross-boundary effects of adaptation, or lack of adaptation, in third countries.

- The need to make progress in tracking climate-related expenditure: although a system for tracking has been introduced, it is sometimes difficult to determine the extent to which investments deliver adaptation benefits on the ground.

The European Long-Term Strategy "A Clean Planet for All", published in November 2018⁴⁸, proposes a vision for achieving climate neutrality⁴⁹ by 2050 through a socially just and cost-effective transition.

Its purpose is to indicate in which direction EU climate and energy policy

should go and to provide a framework for what the EU sees as its long-term contribution to achieving the temperature targets of the Paris Agreement, in line with the UN Sustainable Development Goals, which will affect a broader set of EU policies. This Strategy sets out the need for integrated, long-term planning for emission reductions and adaptation.

It should also be noted that the European Commission, through its Sustainable Finance Action Plan and its regulatory development, is working to turn European Union finances into a key tool for the fulfilment of the 2030 Agenda and its Sustainable Development Goals, as well as the Paris Agreement, so that they are not a marginal issue disconnected from the rules of the functioning of markets, but rather a key element of decisions. Among the measures already put in motion in this area, the development of a common language for the identification of sustainable economic activities, i.e. a unified classification system (or taxonomy) set out in an EU Regulation⁵⁰ stands out, which will help investors and companies to make investment decisions that contribute to the achievement of six environmental objectives, including climate change adaptation. In the context of adaptation, the taxonomy has identified 68 climate change adaptation activities to guide investors

⁴⁷ - <https://www.pactodelosalcaldes.eu/es/>

⁴⁸ - Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank "A clean planet for all: A European strategic long-term vision for a prosperous, modern, competitive and climate-neutral economy".

⁴⁹ - Climate neutrality entails zero net greenhouse gas emissions.

⁵⁰ - Regulation (EU) 2020/852 of the European Parliament and of the Council, of 18 June 2020, on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088.

on what falls within the definition of “sustainable”, distinguishing between two types of adaptation activities: those that increase climate resilience by integrating measures for good performance in a changing climate and activities that enable other economic activities to adapt.

The European Green Deal, published in December 2019, presents a roadmap for a sustainable EU economy, translating climate and environmental challenges into opportunities in all policy areas and emphasizing a fair and inclusive transition that leaves no one behind. It includes a commitment to a new, more ambitious EU strategy on adaptation to climate change, to be defined during 2020/2021.

CIRCULAR ECONOMY, CLIMATE RISKS AND ADAPTATION

In March 2020, the European Commission adopted a new Circular Economy Action Plan, one of the main elements of the European Green Deal. The new Action Plan announces initiatives along the entire life cycle of products, focusing, for example, on designing products for a climate-neutral, resource-efficient and circular economy, promoting the circularity of production processes, encouraging sustainable consumption and advancing waste prevention and management. With a transversal character, the Plan determines that the Commission will analyse how the effects of circularity on adaptation to climate change can be systematically measured, an issue that has been little exploited to date.

In Spain, the Spanish Circular Economy Strategy, *España Circular 2030*, lays the foundations for fostering a new production and consumption model in which the value of products, materials and resources is retained in the economy for as long as possible, in which waste generation is minimised and any waste that cannot be avoided is used to the greatest possible extent.

The circular economy can contribute to reducing the risks of climate change. As we reduce our net consumption of those resources and raw materials that are increasingly scarce as a result of climate change, our dependence on them decreases; the reduction of production and transformative processes can also lead to a lower environmental impact, reducing stress levels on species and ecosystems, increasing their resilience to the effects of climate change and preserving ecosystem services; waste prevention also reduces the risks associated with waste management and treatment facilities, not to mention the necessary contribution of circularity to reducing greenhouse gas emissions.



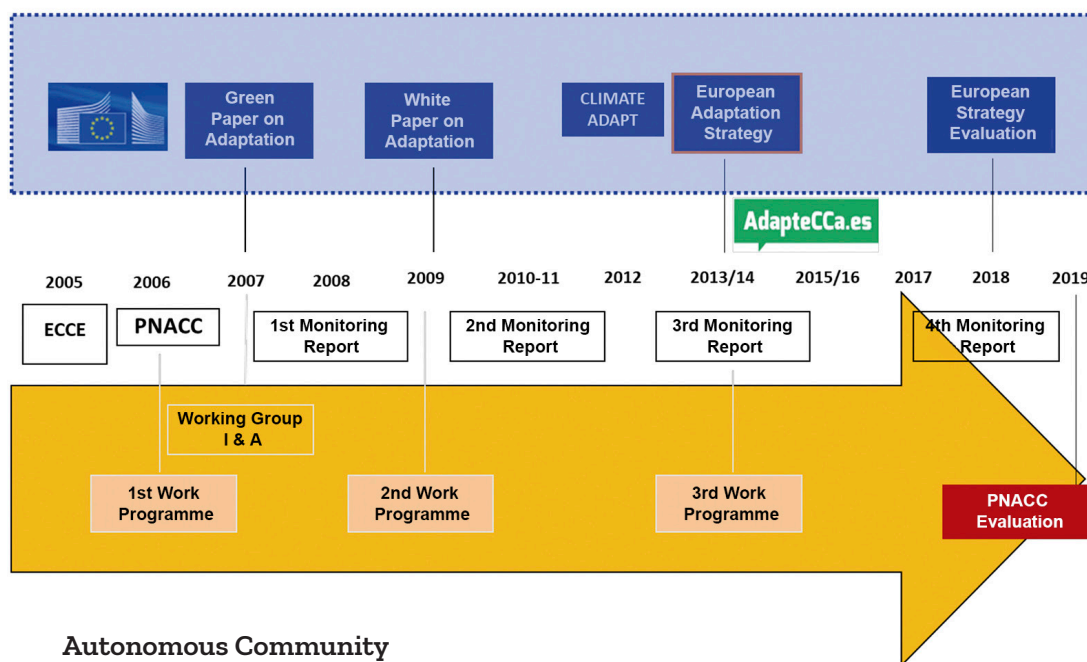
2.4. SPANISH ADAPTATION POLICY

The National Adaptation Plan and its development

Since 2006, the National Climate Change Adaptation Plan (PNACC) has been the reference framework for public efforts to generate knowledge and build adaptive responses to climate change in Spain. The PNACC has been developed through three successive

work programmes, which have jointly defined more than 400 actions, 80% of which have already been implemented or are in the process of being implemented.

The compilation and assessment of the results achieved, which is essential for updating the work plans, has taken the form of a series of monitoring reports, published in 2008, 2011, 2014 and 2018⁵¹.



Autonomous Community initiatives

The autonomous communities, in the exercise of their competences, have developed their own strategic frameworks, plans and/or programmes for adaptation to climate change, which they develop through numerous initiatives and actions. The AdapteCCA platform brings together concise infor-

mation on this and provides access to and detailed knowledge of the frameworks and actions being developed in Spain at autonomous community level⁵². Some Autonomous Communities, such as Catalonia, the Balearic Islands and Andalusia, have reinforced the legal framework by approving their own climate change laws⁵³.

⁵¹ - PNACC monitoring reports are available at: <https://www.miteco.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/plan-nacional-adaptacion-cambio-climatico/default.aspx>

⁵² - <https://www.adaptecca.es/contenido/comunidades-autonomas>

⁵³ - See Law 16/2017 of 1 August (Catalonia), Law 8/2018 of 8 October (Andalusia) and Law 10/2019 of 22 February (Balearic Islands).

Local government initiatives

Most large Spanish cities have approved their own climate change strategies or plans, which in many cases include adaptation objectives and lines of work. Some have conducted their own local-scale vulnerability and impact analyses or have specific adaptation plans, although the latter are still in the minority⁵⁴.

Contributions and lessons learned

In the time that has elapsed since its initial formulation, there have been significant developments in a number of areas related to adaptation, among which the following stand out:

- Relevant advances in the understanding of Spain's impacts and vulnerabilities in the face of climate change, as well as in the social perception of the problem.
- New instruments to support adaptation and numerous open lines of work in the framework of the PNACC and in public policies as a whole.
- New commitments at the international level, including the European Adaptation Strategy (2013), the Paris Agreement (2015) and the new European Energy and Climate Governance (2018).

⁵⁴ - See Sixth report on local climate change policies (2019): https://sextoinforme.redciudadesclimas/sites/default/files/2020-06/Sexto_Informe_sobre_PoliticasyLocales_de_lucha_contra_el_Cambio_Climatico.pdf

THE

NATIONAL

CLIMATE CHANGE ADAPTATION

PLAN

2021-2030

3. THE PNACC 2021-2030 DEFINITION PROCESS

3.1. EVALUATION OF THE PNACC-1

In order to recognise the progress made, challenges remaining and lessons learned in the development of the PNACC, the Ministry for the Ecological Transition and the Demographic Challenge (MITERD, in Spanish) has developed an evaluation of the plan since its creation in 2006. The evaluation process began in February 2018, with the formation of an advisory group made up of experts from different fields: European institutions, the Central Administration, autonomous communities, the academia and the non-governmental sector. This advisory group has contributed, with its assessments and proposals, to the orientation of the evaluation process.

The evaluation exercise has drawn on several complementary sources, including:

- a) The analysis of a wide range of documents, including international commitments and recommendations, as well as the conclusions of working groups and seminars.
- b) The opinions, assessments and suggestions of people working in the field of adaptation in Spain, collected through a survey completed by more than 300 people, and a series of in-depth interviews with key actors in the field of adaptation in Spain⁵⁵.
- c) Analysis of the fulfilment of the actions set out in the Plan and its successive work programmes. This task has led to the review of the approximately 400 actions proposed in the PNACC and the three successive work programmes through which the plan has been developed.

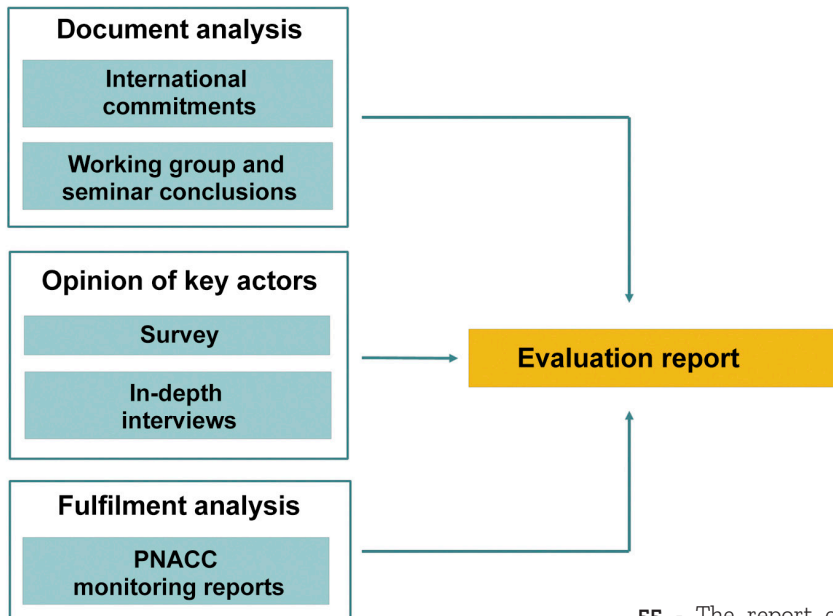


Figure 8. Sources used in the evaluation of the PNACC (prepared by the authors)

⁵⁵ - The report containing the results of this study is available at: https://www.miteco.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/pnacc_informe_valoraciones_actores_tcm30-499004.pdf

According to the evaluation⁵⁶, the PNACC has made some important achievements, among them:

- It has made it possible to place adaptation on the agendas of institutions, both at state, regional and local level. Today, adaptation occupies a space in the different public policies, plans and strategies implemented in almost all autonomous territories and many city councils.
- It has enabled the channelling of economic and technical resources towards adaptation, making it possible to advance in knowledge generation, raising awareness among the population and progressively increasing the understanding of the need to adapt different sectors and geographical territories to the climate crisis.
- It has contributed to the mobilisation of relevant actors in the field of adaptation, incorporating them into the public debate on the subject, and opening spaces for reflection, exchange, mutual learning and collective work.
- It has promoted the development of tools for adaptation, freely available to any interested persons, such as regionalised climate change projections, easily accessible through the scenario viewer, the viewer of impacts on the coast, hydrological projections, etc.

The evaluation identifies a number of "emerging issues" that need attention, such as the influence of social and demographic

factors on vulnerability to climate change, the consideration of the transnational impacts of climate change, the integration of a human rights and gender perspective, and the role of lifestyles in building resilience to climate change.

3.2. THE PARTICIPATORY PROCESS IN THE ELABORATION OF THE PNACC-2

Early participation

Prior to the initial writing of the PNACC, preliminary ideas and proposals were gathered from experts and key actors in the field of adaptation. Various consultation and deliberation formats were used for this purpose:

- **Deliberative workshops:** Four workshops were held through which the attendees⁵⁷ were able to communicate, contrast points of view, debate key aspects and prioritise proposals in relation to the different aspects that make up the Plan.
- **Expert contributions through an online form:** After the workshops, all participants had the opportunity to send new reflections and proposals through an online form.

⁵⁶ - The National Climate Change Adaptation Plan Evaluation Report is available at: https://www.miteco.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/informeevaluacion_pnacc_tcm30-499212.pdf

⁵⁷ - A total of 157 people participated in these workshops, with gender parity (51% women, 49% men), representing the different sectors included in the latest PNACC-1 Work Programme.

DELIBERATIVE WORKSHOPS	DATE
Impacts and Adaptation Group Workshop (GTIA) ⁵⁸	02/10/2019
Multisectorial Workshop 1 ⁵⁹	14/10/2019
Multisectorial Workshop 2 ⁶⁰	17/10/2019
Society, Education and Lifestyles Workshop ⁶¹	12-13/10/19

Meetings with implementing agents: The drafting team held meetings with the different departments and potential administrative units responsible for the future development of PNACC-2 lines of action and measures, with the aim of analysing proposals and defining their practical application.

PUBLIC INFORMATION

The initial draft of the PNACC 2020-2030 was subject to a public information period from 4 May to 30 June 2020. Given the transversal and multisectoral nature of climate change adaptation, participation was broad, reflecting a high degree of interest and commitment. More than 1,500 comments were received from 182 organisations and individuals, which enriched the initial proposal.

About two thirds of the comments referred to lines of action and indicators and the remaining third to other parts of the document. The areas that elicited most

comments were "water and water resources", "agriculture, livestock, fisheries, aquaculture and food", "cities, urban planning and building" and "energy".

CONSULTATION OF COLLEGIATE BODIES

After the public information period, the updated draft of the plan was submitted for consideration to the Climate Change Policy Coordination Commission, the National Climate Council and the Environmental Advisory Council, which assessed it in monographic sessions. More than 50 comments and observations were raised in these collegiate bodies, which were studied and assessed, and new changes were incorporated into the draft.

In short, the PNACC-2 is the result of the analyses, assessments and proposals of a wide range of people and organisations. The main milestones in its development are set out in the following diagram.

58 - The Impacts and Adaptation Group held a workshop to discuss and brainstorm the new PNACC, focusing on governance and coordination issues.

59 - The first multisectorial workshop organised discussion groups on 1) water and water resources, 2) insurance and finance, 3) tourism, 4) soil and desertification, 5) biodiversity and protected areas, 6) agriculture, livestock and food, 7) disaster risk reduction and 8) forestry, hunting and inland fisheries.

60 - The second multisectorial workshop organised discussion groups on 1) city, urbanisation and housing, 2) climate observation and regionalised climate change scenarios, 3) transport, 4) industry, 5) oceans and coasts, 6) energy, 7) health, and 8) education, society and lifestyles.

61 - This workshop was co-organised by the OECC, the National Centre for Environmental Education and Fundación Biodiversidad, in the framework of the LIFE SHARA project.

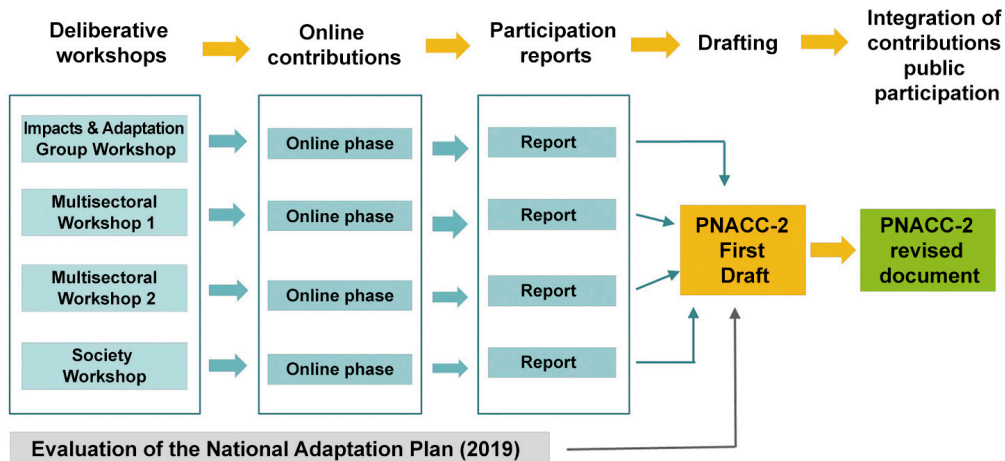


Figure 9.

Participatory process for the elaboration of the PNACC 2021-2030 (prepared by the authors).

4. OBJECTIVES OF THE NATIONAL CLIMATE CHANGE ADAPTATION PLAN 2021-2030

The general objective of the PNACC 2021-2030 is to promote coordinated and coherent action to address the effects of climate change in Spain in order to avoid or reduce present and future damage from climate change and to build a more resilient economy and society.

For this purpose, the PNACC 2021-2030 sets out the following **specific objectives**:

- Reinforce systematic climate observation, the production and updating of regionalised climate change projections for Spain and the development of climate services.
- Promote a continuous and cumulative process of knowledge generation on impacts, risks and adaptation in Spain and facilitate its transfer to society, reinforcing the development of methodologies and tools to analyse the potential impacts of climate change.
- Promote the acquisition and strengthening of capacities for adaptation.
- Identify the main climate change risks for Spain, taking into account their nature, urgency and magnitude, and promote and support the definition and implementation of the corresponding adaptation measures.
- Integrate adaptation into public policies.
- Promote the involvement of all interested actors, including different levels of government, the private sector, social organisations and the general public, to actively contribute to constructing responses to climate change risks.
- Ensure administrative coordination and strengthen governance on adaptation.
- Fulfil and develop the commitments undertaken by Spain in the European and international context.
- Promote the monitoring and evaluation of adaptation policies and measures.

5. GUIDING PRINCIPLES

The lines of action contained in this National Plan should be developed in accordance with a number of guiding principles, which are summarised below.

5.1. SOCIAL AND TERRITORIAL EQUITY FOR A JUST FUTURE

Consideration of the social and territorial dimensions of exposure and vulnerability to climate change

The impacts of climate change are unevenly distributed across the territory and society. Economic inequality and unequal access to services and social protection, or the dynamics of depopulation in inland territories, are examples of factors that can reduce social resilience. Consequently, the social components of exposure and vulnerability, as well as their geographical distribution⁶², should be taken into account in climate risk analyses and in the definition of adaptation initiatives.

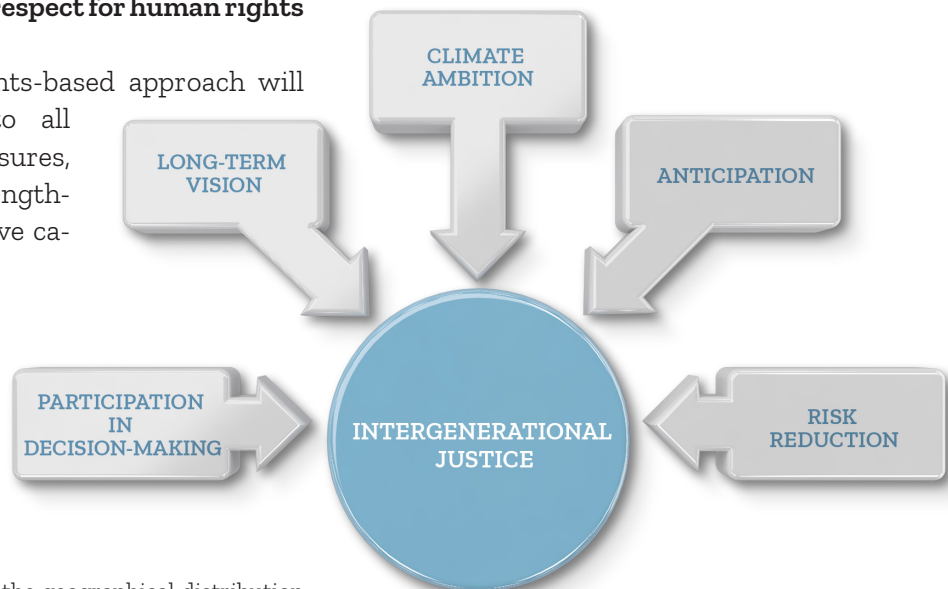
Promotion and respect for human rights

The human rights-based approach will be integrated into all adaptation measures, promoting the strengthening of the adaptive ca-

capacity of all people, especially the most vulnerable, for the full exercise of their rights, and ensuring non-discrimination, equity, meaningful and informed participation and accountability.

Intergenerational justice

The level of effort we undertake today on adaptation and mitigation will determine the future impacts of climate change, which will fall primarily on future generations. In that sense, when assessing adaptation options, the next generations must be taken into consideration, recognising children and young people as interested parties in current public policies. The primary focus of the actions will take into account moral aspects of imposing intergenerational risk and will be guided by the ethical requirements of fair and sustainable natural resource management.



⁶² - The analysis of the geographical distribution of exposure and vulnerability should incorporate the detailed distribution in urban and rural space, where relevant.

Figure 10.
Key factors of intergenerational justice
(prepared by the authors)

5.2. SCIENCE, KNOWLEDGE AND SOCIETY AT THE SERVICE OF ADAPTATION

Consideration of adaptation from different areas of knowledge

Numerous areas of knowledge are making valuable contributions to analysing the impacts and limiting the risks of climate change. The PNACC adopts a multidisciplinary approach, considering different perspectives useful for limiting the impacts of climate change.

Scientific basis and the precautionary principle

Adaptation decisions must be based on the best available science. However, the primary objective of these decisions will be to ensure a high level of environmental and health protection, even in cases where the available scientific data do not allow for a full risk assessment or evaluation.

Contingency planning

When incorporating the risks and impacts of climate change, planning should be carried out in response to a range of pre-determined scenarios. The most unfavourable scenarios should also be considered, especially in relation to responses to extreme events.

Integration of scientific, technical and social contributions

The definition of adaptation responses should be based on scientific and technical analyses, but the definition of which levels of risk are acceptable or which are the most advantageous risk reduction options among

all the technically feasible options has an undeniable social and political component. The two dimensions must interact constructively to achieve socially-supported, technically and economically feasible decisions.

5.3. TRANSVERSALITY AND INTEGRATION IN PUBLIC MANAGEMENT

Sectoral integration of adaptation

Policies and public management in the different economic areas and ecological systems must incorporate adaptive criteria aimed at reducing the risks posed by climate change.

Integration of adaptation and mitigation policies

Mitigation and adaptation are complementary strategies in the face of climate change. The National Adaptation Plan should take advantage of the synergies between the two strategies, promoting low-carbon and climate-resilient solutions.

Ecosystem approach and nature-based solutions

Adaptive solutions will be inspired and supported by nature and its functions, seeking the environmental, social and economic benefits and the creation of resilience associated with solutions that are coherent with natural processes.

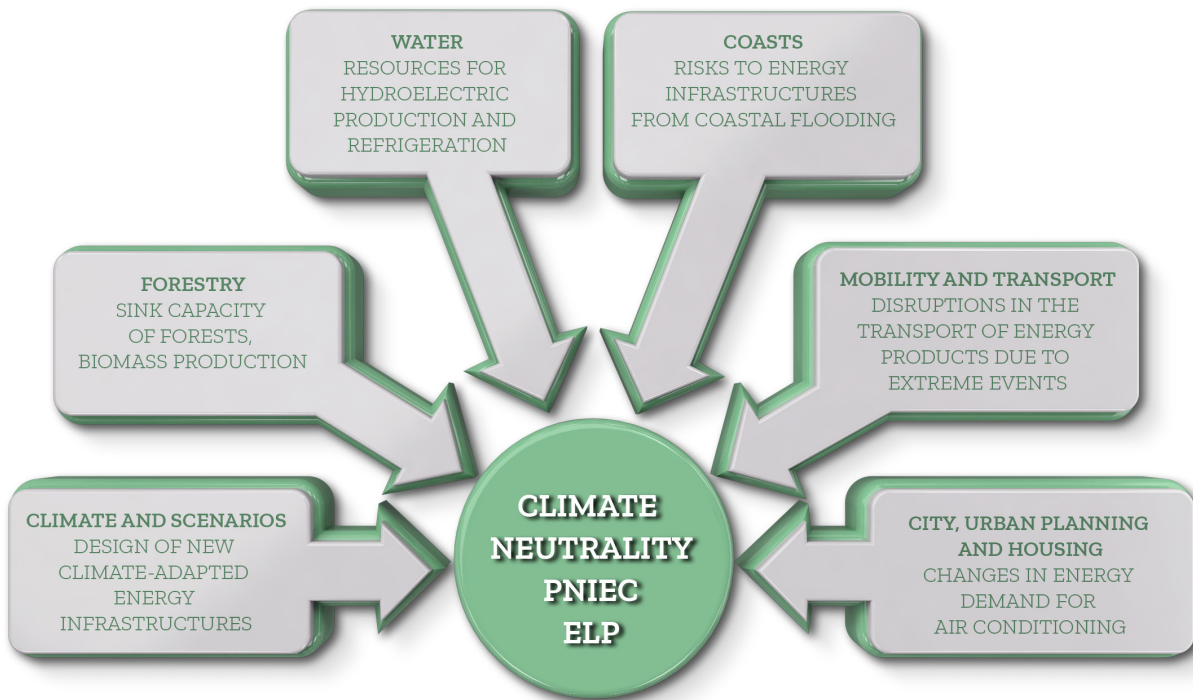


Figure 11.

The importance of coordinated action (prepared by the authors).

The figure shows some examples of the PNACC areas of work that influence the energy transition processes oriented towards climate neutrality set out in the National Integrated Energy and Climate Plan 2021-2030 (PNIEC, in Spanish) and the Long-term strategy for a modern, competitive and climate-neutral economy by 2050 (ELP, in Spanish). Climate change poses risks and constraints on the energy transition, which the PNIEC must consider and the PNACC must help to manage. On the other hand, the decarbonisation process established in the PNIEC and the ELP contributes to the definition of the levels of risk and resilience to climate change for the Spanish economy, society and natural systems, which the PNACC must take into account. In this sense, the different planning instruments for the ecological transition should be periodically adjusted to ensure coherent action.

Integration of international commitments

The PNACC will promote compliance with the adaptation commitments acquired by Spain as a signatory of the UNFCCC and other international agreements.

5.4. ADDRESSING UNWANTED EFFECTS

Preventing maladaptation

Actions aimed at adapting to climate change must avoid “maladaptation” by detecting and discarding measures that may be counterproductive from an adaptive

perspective, that contravene any of the sustainable development objectives, or that negatively affect mitigation.

5.5. COORDINATED, TRANSPARENT AND EFFECTIVE ACTION

The National Adaptation Plan also responds to a series of principles that, in a more general way, govern the actions of the public administration, among which we highlight, due to their relevance:

Institutional cooperation

Adaptation to climate change occurs on different scales and in different sectors. Coordination between institutions is therefore a strategic factor in defining effective and synergistic responses.

Sectoral policy coherence

All policies should integrate climate change adaptation and be oriented toward

contributing to this objective, avoiding contradictions. Coherence between sectoral policies allows the optimisation of adaptive responses to climate change.

Transparency

Information on impacts, vulnerability and adaptation policies and measures should be made available to interested individuals and organisations in a timely and effective manner.

6. STRATEGIC COMPONENTS FOR ADAPTATION ACTION

This plan will pay specific attention to a number of strategic dimensions that facilitate the definition and development of effective adaptation initiatives:

6.1. KNOWLEDGE GENERATION

Adaptive responses must be based on an adequate understanding of the risks posed by climate change. The PNACC will therefore continue to promote knowledge generation in this field, including in new economic, social and ecological areas. It is also necessary to generate new knowledge in the fields related to the design and evaluation of adaptation strategies and measures.

Many of the lines of action defined in this plan include aspects related to knowledge generation. In general, within the framework of the PNACC-2:

- Analyses will be carried out to detect knowledge gaps that need to be addressed.
- Guidelines will be developed for the elaboration of assessments of the impacts and main risks of climate change

contents and recommended methodologies for sectoral assessments).

- Practical tools (projections, scenario viewers, guidelines for the use of scenarios, manuals, etc.) will be developed for the elaboration of exposure and vulnerability studies.
- Where appropriate, new types of analysis will be incorporated, such as the analysis of worst case scenarios and environmental and social tipping points.
- Specifically, the contributions generated by successive IPCC reports will be analysed in order to facilitate their transfer to the risk analyses and the design of actions carried out within the framework of the PNACC.

6.2. INTEGRATION INTO SECTORAL PLANS, PROGRAMMES AND REGULATIONS

The incorporation of adaptation into sectoral policies is crystallised through its integration into the plans and programmes drawn up by the public administrations, as well as in the regulations that regulate activity in each sectoral area.

In order to improve the integration of adaptation into sectoral plans, programmes and regulations, this Plan will actively identify strategies, plans and programmes that could incorporate aspects related to climate change. The strategies and plans that are scheduled to be developed or updated in the near future, where it is considered necessary to incorporate or reinforce the adaptive approach, include the following:

Water

- River Basin Management Plans
- Flood risk management plans
- National Plan for Water Purification, Drainage, Efficiency, Saving and Reuse
- Drought Management Plans

Biodiversity

- Natura 2000 Network conservation plans and guidelines
- National conservation strategies and plans for the conservation and recovery of endangered species
- National strategies for invasive alien species
- Strategic Plan for Natural Heritage and Biodiversity

Coasts and marine environment

- Marine strategies (new cycles)
- Strategies for the protection of the Spanish coastline/Plans for the protection of the coastal area

Energy

- Storage Strategy
- Long-term strategy for energy rehabilitation in the construction sector in Spain 2020
- National Integrated Energy and Climate Plan

Agriculture, forestry, desertification

- Spain's Strategic Plan for the Common Agricultural Policy 2021-2027

- National Action Programme to Combat Desertification
- Spanish Forestry Strategy
- Spanish Forestry Plan
- National Irrigation Plan

Health

- National Health and Environment Plan
- National Plan of Preventive Actions on the Effects of Excessive Temperatures on Health

Territory

- State Strategy for Green Infrastructure and Ecological Connectivity and Restoration
- Strategy for Safe, Sustainable and Connected Mobility
- Spanish Urban Agenda

Other sectors

- Strategic Framework in SME Policy 2030
- Spanish Circular Economy Strategy 2030
- National Action Plan for Sustainable Finances
- Sustainable Tourism Strategy for Spain 2030
- Spanish Strategy for Science, Technology and Innovation 2021-2027
- Action Plan for the Internationalisation of the Spanish Economy

Society

- Action Plan for Environmental Education for Sustainability 2021-2025
- Strategic Plan on Education and Healthy Lifestyles 2021-2025
- Strategic Plan for Equal Opportunities 2020-2022
- Special Civil Protection Plans
- Strategy to Combat the Demographic Challenge

Adaptation to climate change should also be incorporated into some legislation currently being prepared, such as the Law on Industry and Industrial Strategy. Other existing legislation could require modifications to strengthen adaptation to climate change, such as the Coastal Law, the Consolidated Text of the Water Law, the Law on Environmental Assessment and the Law on Environmental Health.

Furthermore, within the framework of this axis of integration, the application of regulations, plans and programmes that already incorporate aspects related to climate change will be analysed from an adaptation perspective and barriers and limiting factors that hinder the adequate sectoral integration of adaptation will be identified, as well as success stories and good practices.

ENVIRONMENTAL ASSESSMENT AS AN INSTRUMENT OF INTEGRATION

Environmental assessment is a fundamental instrument for integration, with a preventative nature, of climate change adaptation in plans, programmes and projects that may have significant effects on the environment.

Environmental assessment, regulated by Law 21/2013, of 9 December, is the process through which the significant effects that plans, programmes and projects may have on the environment are analysed prior to their adoption, approval or authorisation. This law introduces the obligation to consider climate change during this process, explicitly including it among the factors that must be taken into account.

In this sense, both the strategic environmental study and the environmental impact study (which are the documents that identify, describe and analyse the possible significant effects on the environment arising from plans, programmes and projects) must consider the impacts of climate change and the need for adaptation

in response to them. This includes measures to enable adaptation in different sectors and socioecological systems, as well as the interactions between them.

Based on the provisions set out in the regulation, and within the framework of the National Adaptation Plan, measures aimed at facilitating the integration of climate change adaptation into environmental assessment procedures, especially by promoters and the environmental agency, will be encouraged. To this end, the following priority lines have been identified:

- a) Improve the consultation tools that facilitate the integration of climate change into assessments (scenario viewers, sectoral and territorial assessments, etc.).
- b) Develop methodological manuals to facilitate the integration of climate change into assessments.
- c) Promote capacity building for people working in the field of environmental assessment.



6.3. MOBILISATION OF ACTORS

Adaptation to climate change can only be conceived as a collective project, involving a wide range of institutions. In order to enable the active and conscious involvement of different actors, public and private, the PNACC-2 will continue to promote information, dissemination, capacity building, research and innovation, and social participation⁶³.

Dissemination

The risks and impacts derived from climate change, as well as the responses proposed to avoid or reduce them, must be translated from scientific, technical and administrative language into understandable and meaningful forms for the general public. The media and social communicators play an essential role in this process, as well as the field of culture and art.

The PNACC 2021-2030 will contribute to this dissemination task by contemplating the elaboration of communicative resources in different formats (informative guides, exhibitions, audiovisual materials and others), continuing the work already initiated⁶⁴.

Capacity building

In order to achieve the objectives of this National Plan, systematic work is required to build the personal and collective capacities

that will enable Spanish society to make its best contributions.

In many cases, it will be necessary to identify the new capacities required, the key actors involved and their specific capacity-building needs, as well as the most appropriate educational and formative formats (which may include study visits to inspiring projects, professional exchanges, learning through practical projects, seminars and workshops, etc.) and the most suitable institutional framework (formal education system, non-formal education or informal education).

In the "Education and Society" area of work, a series of lines of action are proposed for this purpose.

Social participation

Adaptive responses will hardly be adequate and effective without the active involvement of those people and communities affected or capable of responding to the identified risks. In this sense, adaptation processes must include appropriate formulas that allow for the involvement of society in the diagnosis, definition of objectives, identification or design of measures, their implementation and evaluation of the process.

In the face of the specific risks arising from climate change, it is necessary to build adapted communities that are aware of the

⁶³ - In line with the recommendation made by the UNFCCC to systematically integrate education, training, public awareness, participation and access to information on adaptation actions including the design and implementation processes of national adaptation plans. (Point 5, FCCC/SBI/2018/L.3/Add.2)

⁶⁴ - In this field, it is worth highlighting the initiatives and resources developed in the framework of the LIFE SHARA project (Sharing awareness and knowledge for adaptation to climate change), a joint project of Fundación Biodiversidad, OECC, AEMET, CENEAM and the Portuguese Environment Agency: <http://www.lifeshara.es/>

risks that affect them, have the capacity to learn, are inclusive, have effective governance mechanisms and the capacity to participate in the construction of adaptive responses.

The adoption of a participatory approach to adaptation planning and development is supported by the UNFCCC Adaptation Committee, which encourages Parties to “make use of stakeholder input, including from the private sector, civil society, local communities, migrants, children and youth, persons with disabilities and people in vulnerable situations” (UNFCCC/SB/2018/L.5). Furthermore, in line with one of the activities outlined in the Gender Action Plan adopted at COP 25, participation at all levels needs to include women, women’s groups and gender institutions⁶⁵.

In order to promote the mobilisation of social actors, within the framework of the PNACC:

- The development of self-diagnoses on risks, impacts and adaptation to climate change by key actors (business, trade unions, social organisations and others) will be supported.
- Sectoral and inter-sectoral discussion and exchange forums will be promoted.
- Collegiate bodies and working groups will continue to be promoted.
- Collaboration agreements will be facilitated to enable the coordinated work of public and private organisations.

Social research

Adequate analysis of social knowledge, perceptions and behaviours relevant to climate change adaptation is a key element in order to adequately target dissemination and capacity-building efforts, as well as to better approach the processes of social participation. In this sense, social research, both quantitative and qualitative, is an essential tool to facilitate social mobilisation for adaptation. For this reason, within the framework of the PNACC, support will be given to the development of social studies that will make it possible to recognise, among other issues:

- The evolution of social perceptions of climate change risks.
- Knowledge of climate change, impacts and adaptation, including the level of misconceptions and misunderstandings.
- The skills and capacities to cope with change and uncertainty that many traditional activities have in their cultural heritage which can benefit innovative adaptation strategies and actions.
- Attitudes to adaptation and possible social barriers to action.

6.4. MONITORING AND EVALUATION

The planning and development of the PNACC-2 will have an iterative approach, in order to ensure flexible, robust processes that avoid maladaptation, allowing for the regular integration of the best available science⁶⁶.

Within this framework, monitoring and evaluation processes acquire a strategic value

⁶⁵ - See UNFCCC/CP/2019/L.3

⁶⁶ - In line with the recommendations made by the UNFCCC Adaptation Committee (UNFCCC/SB/2018/L.5)

in order to guide monitoring and evaluation initiatives, as they are essential for:

- a) Recognising climate change trends, impacts and associated risks.
- b) Recognising progress in the development of the PNACC, its work programmes and remaining challenges.
- c) Systematising and applying the knowledge acquired through the assessment of the results of the initiatives developed.

With the aim of facilitating the monitoring and evaluation processes of the PNACC-2:

- Monitoring reports on the Plan and its development will be carried out through the Work Programmes, which will be made publicly available.
- Future risks will be identified, with a system of indicators that will enable the recognition of impact trends and the adaptation responses to them in the main areas of work (see section 7).
- Self-diagnosis processes by key sectors and reflection processes aimed at a participatory evaluation of adaptation processes will be encouraged.

7. OBJECTIVES BY AREAS OF WORK

In order to facilitate the integration of adaptation actions into the different fields of public and private management, 18 areas of work are defined, and the sectoral lines of action defined in the Plan are framed within these areas:

- Climate and climate scenarios
- Human health
- Water and water resources
- Natural heritage, biodiversity and protected areas
- Forestry, desertification, hunting and inland fisheries
- Agriculture, livestock, fisheries and aquaculture and food

- Ex-post case studies will be promoted in order to analyse and assess the quality of responses to specific risks, especially in the case of extreme weather or climate events.
- The definition of standardised methods for the definition of risks according to their nature, intensity and magnitude, among others, and the calculation of losses and damages will be promoted.
- Fluid communication will be maintained, through seminars, working groups and other means, with the key actors in the development of the Plan, in order to be understand their assessments and proposals.
- Compliance with European and international commitments on information, monitoring and evaluation will be ensured.

Chapter 10 of this National Plan defines and describes the specific instruments envisaged for the systematisation of information, monitoring and evaluation processes.

- Coasts and marine environment
- City, urban planning and building
- Cultural heritage
- Energy
- Mobility and transport
- Industry and services
- Tourism
- Financial system and insurance activity
- Disaster risk reduction
- Research and innovation
- Education and society
- Peace, security and social cohesion

The objectives for each area of work are detailed below⁶⁷:

7.1. CLIMATE AND CLIMATE SCENARIOS

- Maintain and improve the systemic observation of the atmosphere, land and ocean, as well as the monitoring of the state of the climate and the key variables of the climate system, including the availability and accessibility of data, both for the general public and specialised sectors.
- Maintain and improve meteorological observation for the early warning of adverse weather and climate events, as well as the warning services and communications to advise on potential associated impacts.
- Make available to all interested parties the best possible knowledge on future climate change scenarios and projections so that society can plan its responses with the most reliable and up-to-date information.
- Progress in the development of climate services that will transform basic climate data and information into specific climate products and applications useful to different areas of action.
- Train interested persons so that they can make the best use of the tools and data available and advance in the implication of society as a whole in the knowledge of scenarios and the projection of future climate change in order to progress towards a more informed society.

7.2. HUMAN HEALTH

- Identify the risks of climate change on human health and develop the most effective adaptation measures by integrating climate change into national health and environment plans.
- Promote preventive action to address the health risks of excess temperatures.
- Prevent the health risks from vector-borne and non-vector-borne infectious and parasitic diseases favoured by climate change.
- Identify the impact of climate change on air quality and identify synergies between climate change adaptation and mitigation measures in this field.
- Prevent the occupational health risks of climate change.

7.3. WATER RESOURCES

- Assess the ecological, social and economic impacts and risks derived from the effects of climate change on water resources and associated aquatic ecosystems.
- Deepen the integration of climate change into hydrological planning and integrated water cycle management, giving special priority to the management of extreme events (droughts and floods).
- Reduce risk by promoting sustainable adaptation practices, pursuing multiple objectives, on water use and management, as well as on extreme events.

⁶⁷ - The objectives have been defined by considering a number of factors, including: a) the significance of the specific risks involved (related to aspects such as the magnitude of the expected impacts or their

imminence), b) the value of possible adaptive responses to reduce the risks, and c) the material and human resources that could be mobilised to implement measures effectively.

- Strengthen the collection of key parameters for monitoring the impacts of climate change on the hydrological cycle, water use and extreme events.

7.4. NATURAL HERITAGE, BIODIVERSITY AND PROTECTED AREAS

- Update studies on the expected effects of climate change on Spain's flora, fauna and geological heritage, as well as on the structure and functioning of the terrestrial and marine ecosystems of which they form part.
- Support policies and measures aimed at reducing the levels of stress on species and ecosystems, in order to help them adapt, maintaining their biodiversity and resilience in the face of climate change.
- Promote the introduction of climate change adaptation criteria in the planning and management of protected areas.
- Strengthen the adaptive capacity of green infrastructure and ecological connectivity, including the conservation and expansion of ecological corridors, in order to boost the adaptive responses of species.
- Promote climate change adaptation measures that harness the potential of nature-based solutions as a means to strengthen the resilience of species and ecosystems.
- Prevent and address the risks associated with the proliferation of invasive species as a consequence of climate change.

7.5. FORESTRY, DESERTIFICATION, HUNTING AND INLAND FISHERIES

- Deepen knowledge on the impact of climate change on forest resources, including both timber and non-timber products, taking into account the effects on ecosystem goods and services.
- Integrate climate change adaptation into forest planning and management to ensure the provision of ecosystem goods and services.
- Integrate climate change adaptation into the planning and day-to-day management of hunting activities and inland fisheries.
- Prevent desertification and land degradation and promote adaptive restoration of degraded land.
- Promote action against forest wildfires, through integrated wildfire prevention and wildfire-fighting plans, harnessing the potential of nature-based solutions in a context of climate change and climate change adaptation.

7.6. AGRICULTURE, LIVESTOCK, FISHERIES AND AQUACULTURE AND FOOD

- Reduce climate change risks to food security⁶⁸.
- Update or expand knowledge on the assessment of the risks (hazards, exposure, vulnerability) and impacts of climate change on the main types of crops, livestock and fish species, as well as on

⁶⁸ - According to FAO, food security exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their

dietary needs and food preferences for an active and healthy life.

the food sector, including the interrelationship of all elements of the food system, and integrate this knowledge into the plans, regulations and strategies of these sectors.

- Promote the development of adaptation interventions through Spain's Strategic Plan for the CAP post-2020 and other instruments.
- Promote the adaptation of agriculture and livestock farming to the climate changes already verified, as well as to those expected, with special emphasis on their adjustment to available water resources through the corresponding management systems.
- Strengthen adaptation to climate change in the Common Fisheries Policy (CFP), national management and recovery plans and the aquaculture sector.
- Promote healthy diets compatible with a sustainable and territorially-integrated food production and the reduction of food waste.
- Promote the sustainability of the food system and adaptation to climate change in rural areas, promoting short distribution channels, the bioeconomy, the circular economy and proximity agriculture, among other strategies for lower climate impact and greater resilience.

7.7. COASTS AND MARINE ENVIRONMENT

- Develop tools for risk analysis and the definition of adaptation initiatives on the coast and at sea.
- Develop adaptation initiatives and promote nature-based solutions for stabilising and protecting the coastline against climate risks.
- Encourage the consideration of climate-related coastal risks in territorial, infrastructure and urban planning in coastal areas.

- Incorporate climate change adaptation criteria into the planning and management of marine protected areas.

7.8. CITY, URBAN PLANNING AND BUILDING

- Strengthen the link between the Spanish Urban Agenda and the new PNACC as governance frameworks.
- Integrate climate change adaptation into territorial and urban planning, developing democratic governance for risk management, involving all interested parties in planning and management.
- Integrate climate change adaptation in the building sector, advancing regulations to improve the energy and water performance of buildings in line with projected climate scenarios for the future.
- Consider future climate change scenarios and projections in the next revisions of the Long-term strategy for energy rehabilitation in the construction sector in Spain 2020

7.9. CULTURAL HERITAGE

- Identify the elements of Spanish cultural heritage that are most vulnerable to climate change and define possible adaptation strategies.
- Incorporate climate change observations and projections into cultural heritage conservation plans⁶⁹.

⁶⁹ - Including the National Cultural Landscape Plan <http://www.culturaydeporte.gob.es/planes-nacionales/planes-nacionales/paisaje-cultural.html> and the National Cultural Heritage Emergency and Risk Management Plan <http://www.culturaydeporte.gob.es/planes-nacionales/planes-nacionales/emergencias-y-gestion-riesgos.html>

- Collect and transfer vernacular knowledge useful for climate change adaptation.
- Promote a cultural tourism that is climate change-adapted and low-carbon.
- Encourage international cooperation in knowledge transfer to protect cultural and architectural heritage in the face of climate change.

7.10. ENERGY

- Improve knowledge on the impacts of climate change on the production potential of renewable energies and translate the results into energy planning.
- Improve knowledge on the potential impacts of climate change on the functionality and resilience of energy generation, transmission, storage and distribution systems and specify adaptation measures to avoid or reduce the identified risks.
- Improve knowledge on the impacts of climate change on energy demand and identify measures to avoid or limit spikes in demand, especially those associated with heat.
- Identify risks derived from extreme events in critical energy infrastructures and implement measures to prevent their loss of functionality.

7.11. MOBILITY AND TRANSPORT

- Review systems for the observation, transmission, storage, analysis, modelling and prediction of infrastructure functionality, taking climate change into account.
- Incorporate climate change adaptation criteria into the strategic planning of the transport sector, including the su-

pport and strengthening of climate change adaptation capacities in public administrations and other key sectors and actors.

- Incorporate climate change adaptation criteria in the construction of new transport infrastructures and the expansion of existing ones (roads, railways, ports and airports), including during the operation and conservation phases.
- Review prevention, maintenance and monitoring protocols for the transport infrastructure considering the risks arising from climate change.
- Complete the development and integration of meteorological risk warning systems for means of transport.

7.12. INDUSTRY AND SERVICES

- Integrate adaptation into sectoral legislation and industrialisation and service sector plans.
- Identify the risks derived from climate change that affect Spanish industry and the service sector, both with regard to their installations, the goods produced and the possible changes in demand.
- Encourage the adoption of adaptation measures for the management of climate change risks.
- Stimulate the generation of new products and services aimed at adaptation.

7.13. TOURISM

- Integrate climate change adaptation into tourism plans, programmes and strategies, including the Sustainable Tourism Strategy for Spain 2030.
- Protect tourist destinations and resources and promote the resilience of tourist infrastructures and facilities.

- Define sustainable tourism models that consider the environmental load capacities and climatic conditions of the destination. Stimulate supply and demand for the creation of a tourism that combines a good adjustment to the new climatic conditions and a low carbon footprint.

7.14. FINANCIAL SYSTEM AND INSURANCE ACTIVITY

- Promote the role of the financial system as a catalyst for climate change adaptation and continue to explore and promote the specific contributions of insurance activities to adaptation, with a special focus on agricultural insurance, and create incentives for risk prevention.
- Promote the generation of knowledge and capacities on the impacts of climate change on the financial system and insurance activities, as well as on the identification of opportunities to contribute to climate change adaptation.
- Promote measures that favour adaptation to the financial risks associated with climate change through analysis, communication and prevention.
- Favour collaboration and cooperation frameworks on climate change adaptation among the different agents involved in the financial system, with special attention to insurance activity, and strengthen adaptation capacities in the sector.

7.15. DISASTER RISK REDUCTION

- Further the prospective assessment of disaster risks considering climate change projections and scenarios.

- Promote the integration of adaptive criteria and measures in the National Civil Protection System (territorial plans, basic plans and special state plans).
- Support and strengthen preventive measures, especially nature-based solutions, as well as observation, early warning, communication and education for disaster risk.
- Encourage the consideration of risk analyses associated with climate change in the study, analysis and definition of self-protection measures and promote self-protection for the different disaster risks related to climate change.

7.16. RESEARCH AND INNOVATION

- Integrate adaptation into future science, technology and innovation strategies and plans.
- Drive the creation of spaces for exchange, collaboration and coordination between research staff and the different actors involved in adaptation.
- Promote the development of methodologies and tools for estimating climate change risks and informed decision-making for adaptation.
- Support Spanish participation in the IPCC and the dissemination and transfer of the contents of its reports on adaptation.

7.17. EDUCATION AND SOCIETY

- Promote access to information, awareness raising and effective communication on the impacts and risks of climate change and the ways to avoid or limit them.
- Promote capacity building in order to address the climate change risks in the

formal education system and, in particular, in technical and vocational training.

- Identify groups and communities that are particularly vulnerable to climate change risks and promote their resilience through social and community capacity-building processes.
- Promote resilient and climate-adapted lifestyles.
- Prevent the destruction of employment associated with the impacts of climate change and enhance the employability and new employment opportunities associated with adaptation.
- Foster training and capacity building for new jobs and meet new demands associated with climate change adaptation.
- Facilitate public participation in the study of climate change and its effects and in the elaboration of adequate responses.

7.18. PEACE, SECURITY AND SOCIAL COHESION

- Promote peace and security in the face of the impacts of climate change at the national level through the early detection of potential conflicts for its prevention, strengthening mechanisms to promote peace, security and social cohesion in the face of climate change, and the integration of the knowledge of climate change risks into national security.
- Integrate climate change adaptation into the prevention, management and resolution of international conflicts and crises and the construction of a peaceful, just and inclusive global society.

7.19. INTERRELATIONSHIPS BETWEEN AREAS OF WORK

As Figure 12 shows, the defined areas of work are clearly interrelated, which is why it is necessary to strengthen the coordination between sectoral policies in order to achieve maximum coherence in the implementation of climate change adaptation measures.

It is important to note that the defined areas of work respond to operational needs and are not watertight compartments in responding to the identified risks. In fact, the management of climate change risks is carried out, in a complementary manner, through different areas of work and lines of action (L.A.). By way of example, reducing the risks associated with flooding is addressed from various different lines of action, of note:

- Improving observation systems aimed at the early warning of extreme hydrometeorological phenomena (L.A. 1.2.).
- Improving Flood Risk Management Plans, incorporating the climate change variable (L.A. 3.4).
- Integrating risks and adaptation to climate change in territorial and urban planning (L.A. 8.2).
- Creating incentives for risk prevention, integrating adaptation into insurance activities (L.A. 14.2)
- Integrated disaster risk assessment considering climate change projections and scenarios (L.A. 15.1)
- Strengthening self-protection systems against climate disasters in at-risk communities (L.A. 15.4)
- Capacity building for at-risk communities to enable them to actively participate in collective risk prevention and management processes (L.A. 17.4)

In parallel, lines of actions aimed at flood risk management provide co-benefits in different areas of work, such as

biodiversity conservation or health protection.

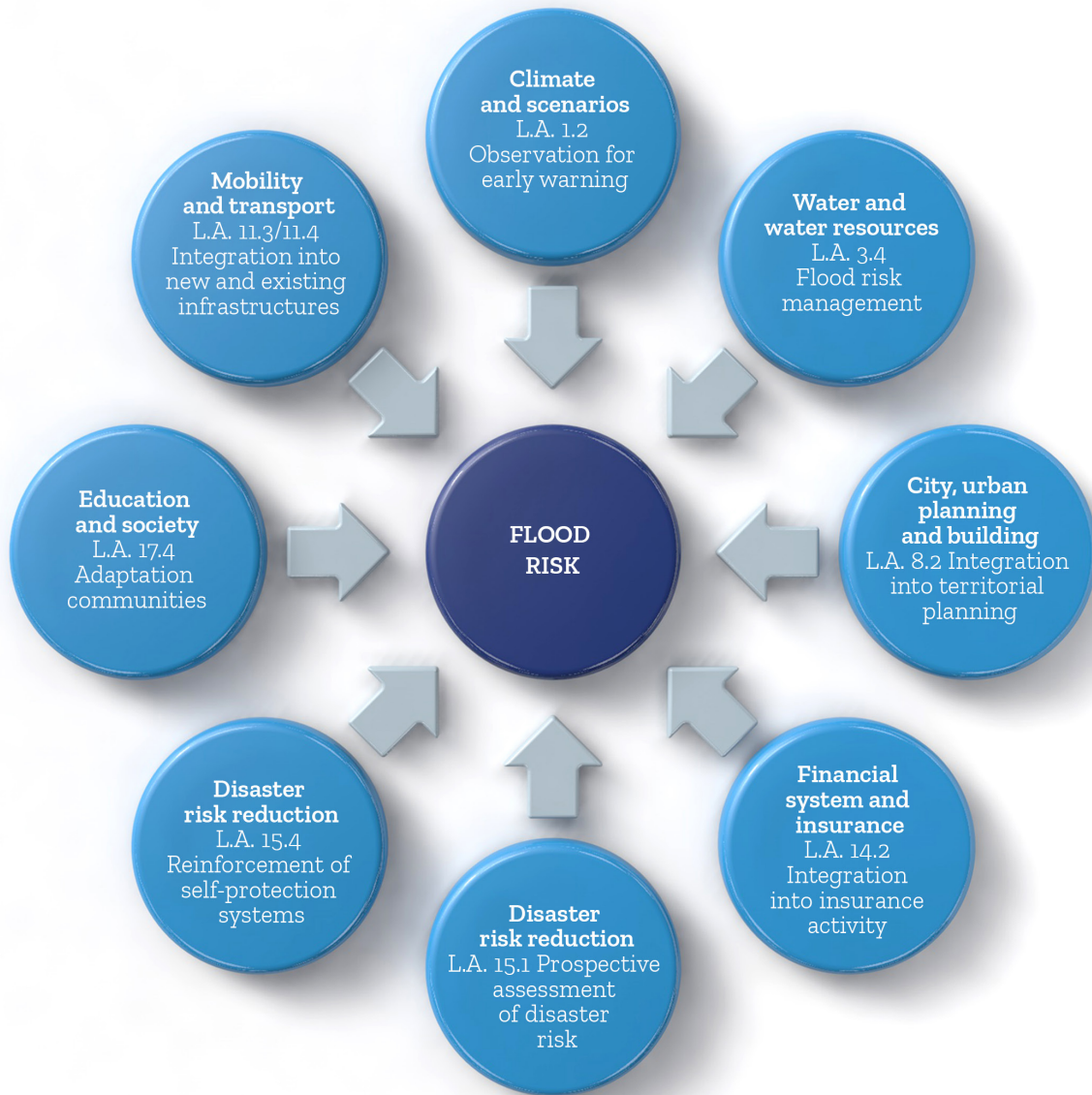


Figure 12.
Lines of action most closely related to flood risk management

A matrix of the interrelationships between areas of work is presented below. Although most of them are related in some way to each other, this table should be understood as an attempt to represent the intensity of these relationships from the perspective of climate change adaptation.

In other words, it is an attempt to reflect the extent to which adaptation in certain areas affects adaptation in others. The matrix is intended to visually capture the great complexity of climate change adaptation due to the multitude of connections that exist.

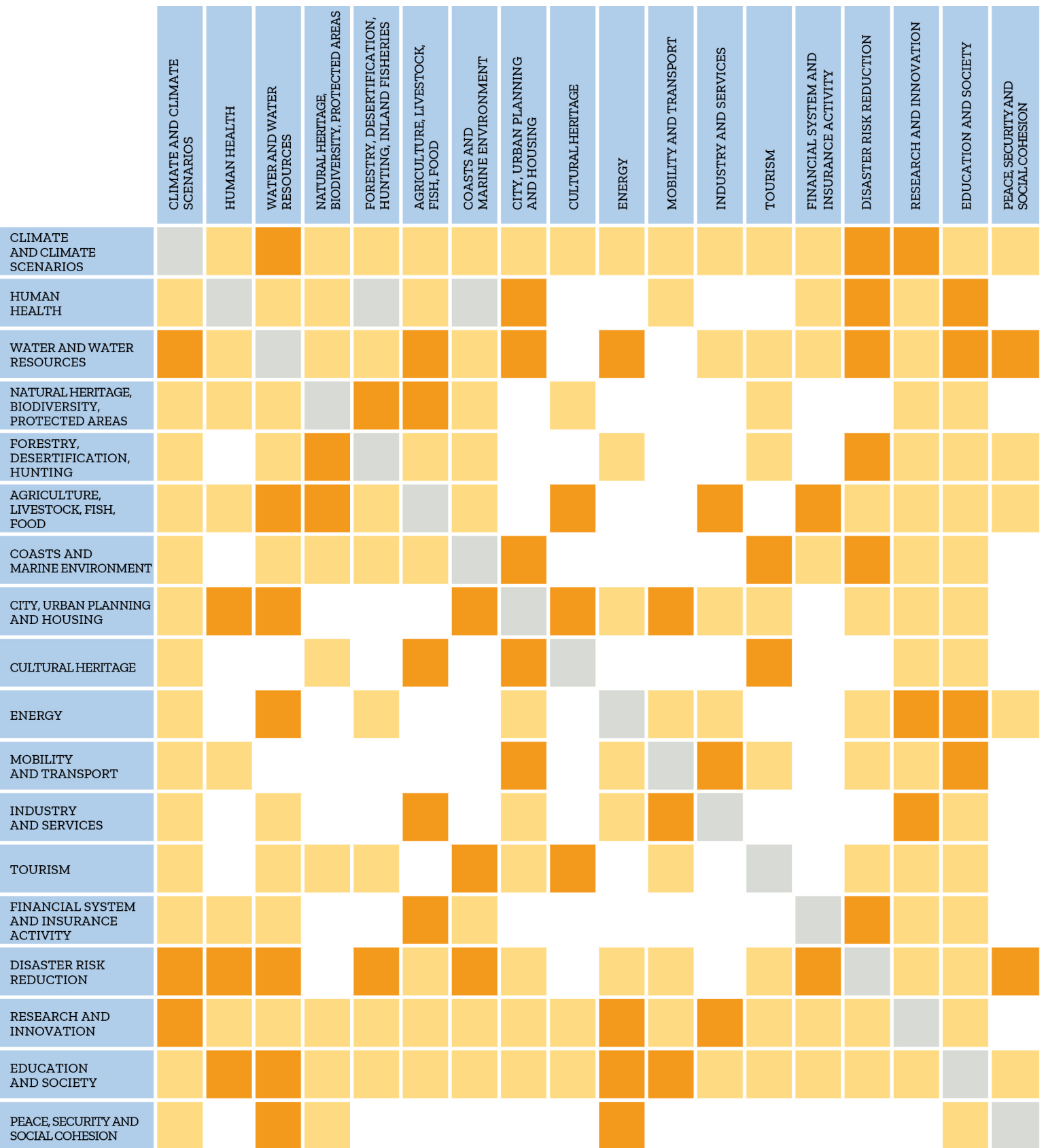


Figure 13.

Matrix of the interrelationships between areas of work on adaptation (prepared by the authors) (in white, low interactions; in yellow, medium interactions; in orange, high interactions).

8. TRANSVERSAL ASPECTS

As a complement to the sectoral action, various transversal elements are defined below, which must be considered when progressing through the process of identification of the impacts - risk analysis – identification of the adaptation actions - implementation of the actions - evaluation of the results.

8.1. TERRITORIAL VULNERABILITY

The actual and potential impacts of climate change are unevenly distributed across the territory. These territorial differences (which may have geographical, economic, social, demographic roots, etc.) must be identified in risk studies and taken into account in the definition of adaptation measures. Therefore, whenever geographical variability and available data allow, risk analyses carried out within the framework of the PN-ACC will incorporate an analysis from a spatial perspective in order to identify areas subject to higher levels of risk (for example, those particularly exposed to risk due to their physical features, those highly dependent on a particularly vulnerable economic sector or those with declining populations).

Climate change takes different forms in different territorial typologies: mountains have specific risk and impact typologies, as do, for example, rural areas (see box on territorial imbalance, depopulation and adaptation to climate change) and islands. For this reason, the PNACC should explicitly analyse the specificities in the risks and the adaptative re-

sponses and the adaptive responses for these types of territorial units.

8.2. SOCIAL VULNERABILITY

The actual and potential impacts of climate change also affect different human groups unequally due to, among other reasons, their differing vulnerability. These differences in vulnerability may be related to, for example, socio-demographic variables such as age, gender, education level or income level, population dynamics (growing or declining) or employment conditions, which limit the ability to respond to impacts. Identifying vulnerable groups and their location enables vulnerability reduction actions to target these groups and develop socially just adaptive responses. These social differences must be identified in vulnerability studies and considered when defining adaptation measures.

8.3. CROSS-BORDER EFFECTS

Spain is interconnected, in many ways, with the rest of the world. Due to these global connections, the impacts of climate change that occur outside our country result in repercussions in our territory. The global approach to adaptation is one of the new features of this plan. Thus, in order to facilitate the incorporation of cross-border effects in climate change adaptation action, the PNACC 2021-2030 will promote:

- The identification of the chains of impacts derived from climate change that connect our country with spaces beyond our borders and raising awareness among the agents involved.

- Improving knowledge about the impact in Spain of climate change occurring beyond our borders on aspects such as trade, transport and infrastructures, finance, transit of people, ecosystems, geopolitics and security.
- The integration of the trans-border dimension into the lines of action defined for sectoral objectives, where necessary.
- The definition of strategies and initiatives that can contribute to reducing Spain's vulnerability, without negatively affecting European and global vulnerability, enhancing global cooperation on adaptation.

In order to analyse the implications for Spain of the impacts of climate change abroad, it will be necessary to take into account various categories of "flows" through which the impacts can be transmitted: supply chains for food, raw materials, industrial components or services, energy and infrastructure interconnections, trade routes, investment and insurance, the spread of disease vectors, tourism, air pollution, proliferation of invasive alien species, transboundary waters or humanitarian crises and associated migrations and displacements.

8.4. GENDER MAINSTREAMING

There is ample evidence of the different effects of climate change on women and men when a gender perspective is applied, taking into account the multiple forms of discrimination suffered by women and girls throughout history, the differences in gender roles, the different possibilities of access to resources or

the inequalities of power and participation in decision-making.

On the other hand, the fight against climate change opens the door to important processes of change and transformation, which require the consideration of measures to make our societies more just and inclusive, and which must necessarily include a gender perspective. This process of change requires input from all sectors and all actors, and women are key agents of change. Women need to be included at levels of responsibility and decision-making in the process of change towards an emission-neutral and climate-resilient development model, through empowerment and leadership that allows them equal access to decision-making.

8.5. PREVENTING MALADAPTATION AND ELIMINATING PERVERSE INCENTIVES

Maladaptive actions are those that may lead to increased risk of negative climate-related effects, increased vulnerability or loss of well-being, now or in the future. Examples include measures that increase exposure to climate risks (for example, promoting economic development in high-risk locations), measures that fuel climate change itself (for example, increased greenhouse gas emissions), measures that increase environmental, social or economic vulnerability (for example, flood risk downstream transfer), or measures that reduce incentives for adaptation. It is therefore essential to develop maladaptation prevention tools to assess the robustness of adaptation actions and to identify possible counter-productive effects.

In this regard, adaptation initiatives should respect the "do no harm" principle so that all actions and policies contribute to the success of the transition to sustainability, and do not harm other environmental objectives, preventing any adaptation activity from being considered environmentally sustainable if the damage it causes to the environment outweighs the benefits it brings.

Sometimes, institutional frameworks, regulations or public actions can incentivise decisions that increase the risks of climate change. These "perverse incentives" can affect the decisions of individuals, private organisations and local, regional and national public administrations⁷⁰. Their identification and review can, in many cases, be of strategic value in achieving an environment that fosters adaptation by allowing for a more coherent alignment of incentives.

8.6. COSTS AND BENEFITS OF ADAPTATION AND INACTION

Different adaptive responses entail a range of costs (the cost of planning, preparation, promotion and implementation of adaptation measures, including transition and opportunity costs) and associated benefits (obtained as a result of adoption and implementation of adaptation measures).

Adaptation measures often also entail a number of supplementary benefits or co-benefits (such as reduced damage from current climate variability, or benefits related to socio-economic development, quality of life, biodiversity conservation, human health, etc.)⁷¹. Finally, we cannot forget the residual costs, in other words, the costs of climate change that remain despite the implementation of measures.

In addition to their clear environmental and social aspects, adaptation measures also make economic sense. Ambitious adaptation measures have an important potential for maintaining and generating employment, as well as preventing economic losses and promoting a more resilient economy. According to the Global Commission on Adaptation report: the rate of return on investments in enhancing resilience is very high, with cost-benefit ratios ranging from 1:to 1:10, and in some cases even higher. This means that every euro invested in adaptation could result in net economic profits of between and 10 euros.

Furthermore, when integrating the costs and benefits for adaptation decision-making, it is important to take into account the costs of inaction, in other words, the costs that would occur if no planned adaptation action were adopted. These costs will depend on future emissions trajectories, and

⁷⁰ - OECD (2014). Boosting resilience through innovative risk governance. OEDC Publishing, Paris.

⁷¹ - A recent report by Oxford University concludes that "green" projects, compatible with the fight against climate change, create more jobs, generate more short-term benefits per euro invested and provide greater long-term savings than traditional fiscal stimulus me-

asures. This report is very clear: investments in clean technologies come with significant economic multipliers, i.e. for every euro invested the benefits will be multiplied by or 3. This means that when we go into debt to finance these activities, we obtain an increase in GDP that exceeds the increase in debt.

different climate change scenarios will sometimes need to be considered.

8.7. ORIENTATION TOWARDS ACTION

The ultimate goal of this National Plan is to ensure that effective measures to limit the risks arising from climate change and to increase the level of resilience to climate change are implemented and applied. In this sense, it is a plan aimed at achieving tangible actions with defined effects to limit or avoid risks, within a governance framework

9. FINANCING

The financial resources needed to achieve the transformation of global development patterns and more climate-resilient economies require the mobilisation of USD 90 trillion by 2030 (USD 6 trillion per year) in global infrastructure, more than the current total stock⁷². Achieving the proposed climate change adaptation goals requires the alignment of all financial resources, both public and private. In fact, the Paris Agreement recognises, as one of its key objectives, the need to guarantee the coherence of financial flows with low-emission and climate-resilient development.

In Europe, the Multiannual Financial Framework (MFF) 2021-and Next Generation EU exceptional funds (new temporary⁷³ instrument for recovery measures) will help

that ensures maximum coherence between actions.

The promoted actions will comprise both structural and physical measures, which will seek to foster ecosystem-based actions, leveraging their environmental, economic and social co-benefits, as well as social and institutional measures. These different categories of possible actions should be seen as complementary and their simultaneous development should generally be favoured.

to combat the effects of the COVID-crisis and to develop the European ecological transition policies contained in the Green Deal, including the new and more ambitious European Adaptation Strategy. 30% of the total MFF and Next Generation EU expenditure will be allocated to climate-related projects.

Sustainable finance is also emerging as a new paradigm in the finance and investment sector and is starting to be reflected for Europe as a whole through the European Commission's Sustainable Finance Strategy⁷⁴ and reinforced in the national regulatory contexts of our neighbouring countries.

In this context, the Draft Climate Change and Energy Transition Law establishes the framework for reorienting public budgets in

⁷² - OECD data (taken from the report: Investing in Climate, Investing in Growth).

⁷³ - Applicable for the period 2021-2024

⁷⁴ - [European Union Sustainable Finance Action Plan](#)

line with the Multiannual Financial Framework, green procurement and sustainable investments, regulating mandatory learning and transparency tools that help to recognise and assess risks and opportunities and improve investment decisions at both public and private levels.

With all this, and within the specific framework of this second National Adaptation Plan, priorities, lines of work and possible financing instruments are identified, and it will be through the work programmes that the exercise of identifying more specific budgets for the actions envisaged within the lines will be carried out.

It should be remembered here that the varied nature of climate change adaptation actions and the multiplicity of the public management areas and administrative units concerned mean that the sources of funding for the lines of action contained in this plan must also be diverse.

By way of example, some innovative financial mechanisms, such as the public procurement of innovation, can contribute to the promotion of business innovation by facilitating the creation of value chains that contribute to climate change adaptation objectives.

Some examples of instruments that aim to strengthen adaptation financing and that also promote the leveraging of additional funds, both public and private, are briefly outlined in the following paragraphs.

Finally, the general monitoring of public expenditure on adaptation and its evolution over time is considered relevant.

9.1. EUROPEAN INSTRUMENTS FOR FINANCING ADAPTATION MEASURES

Among the European funds and instruments associated with the MFF 2021-that include climate change adaptation actions in their scope, the following stand out:

EUROPEAN SOCIAL FUND PLUS (ESF+):

For the new implementation period 2021- 2027, the European Social Fund Plus includes climate change as a transversal element. Specifically, this programming period includes a specific objective whereby ESF+ will contribute to building "a greener, low-carbon Europe through the improvement of education and training systems necessary for the adaptation of skills and qualifications, the upskilling of all, including the labour force, the creation of new jobs in sectors related to the environment, climate and energy, and the bioeconomy".

MITERD will collaborate with the Ministry of Labour and Social Economy in defining the treatment of climate change adaptation in the strategic documents that will guide the use of this Fund in Spain for the period 2021-2027. The aim is for the ESF+ to play a relevant role in the financing of a set of measures contained in this Plan, especially those related to training and capacity building for technical and professional performance with adaptive criteria, including the possibility of specific financing programmes such as Empleaverde.

EUROPEAN REGIONAL DEVELOPMENT FUND (ERDF)

The ERDF is the structural fund with the largest budget and, for the new programming period, the European Parliament (EP) has demanded that it should be especially dedicated to smart growth and the green economy. The resolution adopted by the EP states that at least 30% should be invested in combating climate change and moving towards a circular economy. In addition, at least 10% of ERDF resources at national level should be devoted to sustainable urban development. Paragraph (iv) of specific objective of these Funds is aimed at promoting *climate change adaptation, risk prevention and disaster resilience*.

In addition, in the proposal for ERDF Regulation for the period 2021-2027, it is established that at least 30% of ERDF resources in Spain must be invested in Policy Objective 2: Greener Europe, which includes Specific Objective IV, aimed at promoting climate change adaptation, risk prevention and disaster resilience.

It is important to note that adaptation to climate change, which was outside the ERDF thematic concentration in the period 2014-2020, is now included in the thematic concentration for the period 2021-2027, which represents an opportunity to access these Funds.

In addition, at least 6% of ERDF resources will have to be dedicated to sustainable urban development, and part of these actions are climate-related. Similarly, part of the funds from the Recovery and Resilience Mechanism could be dedicated to climate change adaptation actions.

EUROPEAN AGRICULTURAL GUARANTEE FUND GUARANTEE FUND (EAGF) AND EUROPEAN AGRICULTURAL FUND FOR RURAL DEVELOPMENT (EAFRD)

EAGF and EAFRD are the funds that finance the Common Agricultural Policy (CAP) through direct payments to farmers (pillar I in the current period 2013-2020) and support for rural development (pillar II), respectively. In the next programming period 2021-2027, currently under negotiation, a simplification of the CAP architecture is foreseen so that each Member State will have to submit a Strategic Plan in which it can plan pillar I and II tools together, rather than independently as done in the past. This will improve coherence in achieving the environmental and climate objectives of the CAP itself. Member States will have to allocate at least 40% of the overall financial envelope of the post-2020 °CAP to environmental and climate change objectives. Furthermore, the introduction of 'eco-schemes' in pillar I offers Member States the opportunity to incentivise additional practices that promote greater adaptation to climate change.

EUROPEAN MARITIME AND FISHERIES FUND (EMFF)

The European Maritime and Fisheries Fund is one of the five European Structural and Investment Funds. Based on the priorities defined in the fund, it can contribute to climate change adaptation through diversification of traditional fisheries, reducing the impact of fishing on vulnerable marine ecosystems, or supporting aquaculture to diversify its production and protect itself against climate-induced risks. Maritime spatial planning and integrated coastal zone

management, as well as maritime boundaries strategies, are broader planning initiatives that can help improve the climate resilience of these communities. At the regional and local level, the EMFF can support community-led development in fishing villages, which can involve local approaches to adaptation. A specific programme, Pleamar, will be sought in order to target and incentivise the funding of these measures.

LIFE Programme⁷⁵: The LIFE environmental support, nature conservation and climate action funding instrument finances climate change mitigation, adaptation, governance and information projects. Private entities, public administrations and non-governmental organisations can apply for LIFE funding.

The climate action sub-programme has become a useful tool for the development of innovative adaptation projects in Spain. In 2017, Spanish projects focusing on adaptation to climate change were approved. In 2018, a further 5.

MITERD will continue to stimulate the submission of projects to LIFE calls for proposals through the LIFE Coordination Office.

MITERD will promote the creation of meeting spaces between LIFE projects on

adaptation, aimed at exchanging experiences and seeking synergies⁷⁶.

Horizon Europe: Successor to H2020, the European Union research and innovation programme. The basic objectives of this programme are to:

- a) Create excellent science which will strengthen the EU's position in the panorama of international science
- b) Develop technologies and applications in order to improve European competitiveness
- c) Research the major issues affecting European citizens

For the new period 2021-2027, Horizon Europe includes, within Pillar II Global Challenges and European Industrial Competitiveness, a cluster dedicated to "Climate, Energy and Mobility". In addition, Horizon Europe also incorporates several "missions", one of which is specifically dedicated to climate change adaptation and social transformation. European Commission documents on Horizon Europe state that the fight against climate change has been allocated a budget target of 35% of the total programme budget out of an agreed total of EUR 75.billion for 2021-2027.

For its part, the **European Investment Bank** (EIB) finances climate action projects, not only in the area of mitigation but also adaptation. The EIB invests, provides

⁷⁵ - <https://ec.europa.eu/easme/en/life>

⁷⁶ - MITERD, through the Fundación Biodiversidad, organised a first meeting for LIFE projects working in the field of adaptation to exchange experiences in 2019.

technical and financial advice and contributes, together with other sources, to the financing of projects on renewable energies, rational use of energy, technological efficiency, sustainable transport, efficient water supply and management, forestry for soil protection and enhancement of carbon sinks, etc. Support for projects is mainly provided through loans.

9.2. NATIONAL INSTRUMENTS FOR FINANCING MEASURES

Sectoral budgets

A significant part of the sectoral effort to be made in terms of adaptation involves adjusting or rethinking existing lines of action so that they incorporate climate change. In this sense, a significant part of this effort, in terms of public spending, will have to be made through the budgets of the department involved. On many occasions, the introduction of new adaptive criteria will not necessarily entail a substantial increase in spending, although it will entail a reorganisation of its distribution.

PIMA Adapta

The Plan to Support the Environment for Adapting to Climate Change (PIMA Adapta, in Spanish)⁷⁷, is a tool that has been in operation since 2015 in order to support the fulfilment of the objectives of the PNACC. PIMA Adapta administers economic resources from the auctioning of emission allowances,

carried out within the framework of the European Emissions Trading System, channeling them towards adaptation projects.

PIMA Adapta will continue to operate as a financial instrument of the PNACC-2, dedicated to generating knowledge and supporting projects on the ground that involve physical transformations, in particular, nature-based solutions aimed at balancing social, economic and cultural needs and maintaining healthy, productive and resilient ecological systems, including:

- Ecological restoration measures that increase the resilience of socioecological systems to climate change.
- Measures aimed at the restoration of the hydrological cycle and the recovery of river connectivity, including the removal of artificial barriers and the restoration of flood zones and wetlands.
- Restoration of critical coastal ecosystems for the protection of the coastline.
- Renaturalisation measures in urban areas, including the restoration of hydrological functions (improvement of water filtration and retention through the increase of permeable surfaces, creation of green roofs, etc.).

PIMA Adapta funds may be allocated to units within the Central Government or distributed to Autonomous Communities for project management purposes.

⁷⁷ - PIMA Adapta has been operational since 2015, providing financial resources for adaptation projects in biodiversity, water, coasts, adaptive restoration and agricultural soil management.

Monitoring of adaptation expenditure

In order to monitor public expenditure on adaptation and its trends over time, the Central Government Budgets should identify the budget items that contribute to adaptation.

To make it easier for the different departments of the Central Administration to properly identify the aforementioned budget items, MITERD, in collaboration with the Ministry of Finance, will prepare a guiding document that includes criteria and examples for the evaluation and quantification of expenditure on adaptation, taking into account the provisions set out in the Draft Climate Change and Energy Transition Bill.

9.3. MOBILISING PRIVATE FINANCE

There is vast potential in the private sector for contributions to the investment of resources in adaptation, both through the internalisation of adaptation measures by the companies themselves and by providing resources to third parties through the financial system.

A growing number of companies and financial entities are already integrating the climate change variable into the design, financing and implementation of their actions.

However, in order to achieve greater private sector participation and, therefore, a greater mobilisation of private financial flows, it is important to have mechanisms and instruments that incentivise such participation. These could include the development of guides and methodologies to guide the design of actions in each area of work (or sectoral area); the integration of adaptation to climate change into lines of public funding that involve the leverage of private financing; the creation of incentives for adaptation in companies; etc. Special consideration must be given to small and medium-sized enterprises, given their relevance in the Spanish productive fabric as a whole and their potential contribution to adaptation.

With regard to the mobilisation of private financial flows, it is important to identify areas that can make a significant contribution to investment in adaptation. This is the case of complementary social welfare systems, which, due to their approach (long-term) and investment criteria (frequent adoption of ESG criteria), can play an important role in the financing of adaptation projects.

In addition, further integration of adaptation in the financial sector will be promoted through area of work "Financial system and insurance activity".

10. INFORMACIÓN, SEGUIMIENTO Y EVALUACIÓN

Transparency and access to information in climate action are fundamental for the greater implication of society as a whole in climate change adaptation. Likewise, the development of a good monitoring and evaluation system will favour accountability and continuous improvement in the adaptation

decision-making process. The Spanish Climate Change Office of the MITERD, as coordinator of the PNACC 2021-2030, will be responsible for organising the information, monitoring and evaluation actions detailed below.

10.1 INFORMATION AND MONITORING

Adaptation to climate change concerns the whole of Spanish society, not just its public administrations: social and educational organisations, businesses and communities must participate in adaptive responses. This is why these responses will be more appropriate if they have:

- Agile, versatile and permanently updated means of access to information
- Analyses of progress and challenges in adaptation in the various ecological, social and economic domains
- Indicators for monitoring trends in impacts and adaptation
- Regular information updates that provide easy access to the latest new developments in adaptation, as well as to comply with international reporting and monitoring obligations.

As a result, the PNACC will facilitate adaptation information and the monitoring of impacts and achievements through a number of complementary tools:

Climate risk and adaptation reports

The large number of impact, risk and adaptation evaluation reports produced within the framework of the PNACC, as well as their breadth, makes it advisable to periodically prepare a global report on climate change risk, which synthesises and provides an up-to-date panorama of the knowledge generated.

Furthermore, given the importance of the idea of risk in the field of adaptation and in this plan, it is necessary to deepen not only in our knowledge, but also in its classification and prioritisation. To this end, it will be necessary to apply methodological tools that enable the arrival at shared visions on aspects such as their urgency, magnitude, immediacy or synergies with other risks.

The Ministry for the Ecological Transition and the Demographic Challenge, in collaboration with other ministerial departments and the autonomous communities, will draw up and publish, at least every five years, a synthesis report on the evolution of the main climate change risks and their impacts, and on the policies and measures aimed at increasing resilience and reducing vulnerability to climate change in Spain.

Sectoral progress reports

Progress reports are analyses of the status of one or more of the PNACC specific areas or sub-areas of work. These reports may be prepared at the request of the Government or the Parliament.

The preparation of these progress reports will be the responsibility of MITERD. For this purpose, MITERD may invite organisations considered relevant to submit reports expressing their analysis and contributions on the matter.

To facilitate the preparation of the reports by these organisations, MITERD will develop methodological guidelines to facilitate the presentation of information on the way in which they are addressing current and future climate change risks and impacts, as well as the policies and measures

they are implementing to reduce or avoid them.

PNACC Monitoring Reports

Monitoring Reports are freely accessible informative summaries that gather information on the actions developed within the framework of the PNACC in a defined period of time, as well as the conclusions, challenges and future perspectives. These reports will consider the compliance indicators associated with the lines of action contemplated in the plan and the measures envisaged in the Work Programmes.

The First National Adaptation Plan produced four monitoring reports (in 2008, 2011, 2014 and 2018)⁷⁸, which demonstrated the usefulness of this instrument as an element of information gathering and accountability.

It is proposed that two monitoring reports will be produced during the validity period of the new PNACC, with indicative publication dates of 2024 and 2029.

The PNACC Monitoring Reports will be drawn up by the MITERD, which will consult the different administrations involved in its development.

Climate change and adaptation indicators

As part of the means for information, monitoring and evaluation, the PNACC 2021-2030 defines a collection of indica-

tors, which are included in annex 2. This provisional collection should be seen as a first step in the creation of a library of indicators, which will need to be refined and improved as knowledge improves.

Indicators are a tool that provide a dynamic view of the effects of climate change impacts and progress made in adaptation, facilitating the continuous improvement of policies and measures based on the analysis of advances achieved and the identification of the challenges that remain. The system of impact and adaptation indicators will also contribute to communicating the relevance of climate change adaptation.

However, it must be taken into account that adaptation measures are rarely the only factor influencing the behaviour of the indicators. Nevertheless, even though changes in parameters are often due to a combination of causes, their evolution over time will provide information on final trends. This, in turn, makes it possible to recognise the extent to which adaptation efforts succeed in counteracting the pressures arising from climate change and other associated physical, economic and social trends.

Annex includes an initial list of the indicators to be documented, as well as a fact sheet briefly describing each of them.

⁷⁸ - <https://www.miteco.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/plan-nacional-adaptacion-cambio-climatico/default.aspx>

In 2021, an in-depth review of this initial list will be carried out in order to complete and, if necessary, adjust the indicators currently provided. To this end, a number of aspects will be assessed, such as the availability of data supporting indicators both in the present and in the future, their representativeness for reporting on key aspects and their continuity over time, as well as their value in meeting the reporting commitments that may derive from the future European Climate Law, the future European Adaptation Strategy and the new Implementing Regulation detailing the reporting obligations under the European Energy and Climate Governance Framework.

The proposed indicators should take into account, as far as possible, the cross-cutting aspects defined in this plan. In particular, the territorial perspective, the social vulnerability perspective, the gender approach and the orientation towards action should be integrated where relevant.

From 2021 onwards, and on a biennial basis, the series of data for the defined set of indicators will be updated and made public.

Platform on Climate Change Adaptation in Spain, AdapteCCa

The exchange platform on impacts and adaptation –AdapteCCa⁷⁹ was created in 2013 within the framework of the PNACC and has become a valuable instrument for accessing information on impacts, vulnerability and adaptation to climate change in Spain. In order to strengthen its role as a

means of access to knowledge and ensure its full functionality, the efforts already underway will continue:

- The systematic incorporation of new content, in order to keep it up to date, shortening as far as possible the time between the generation of documents and their availability through the Platform.
- The improvement of its functionalities (search and visualisation tools, functionalities for working groups, etc.).
- The monitoring of its use and evaluation of its operation, through web analysis tools and periodic visitor surveys.

International reporting obligations on adaptation

The Spanish Climate Change Office of the MITERD will be responsible for complying with the reporting obligations established within the UNFCCC framework, the Regulation on the Governance of the Energy Union and Climate Action, as well as for updating the information included for Spain in the country profile of the European Climate Adapt Platform. The following is a brief summary of the aforementioned reporting obligations:

National Communications to the UNFCCC: Parties included in annex I of the UNFCCC are required to make National Communications every four years (Decision 2/CP.17). Chapter of the National Communication is devoted to "vulnerability assessment, climate change impacts and adaptation measures".

Adaptation Communications: The Paris Agreement states in Article 710: "Each Party should submit and update periodically an adaptation communication, which may include information on its priorities, implementation and support needs, plans and actions, without creating any additional burden for developing country Parties." The Paris Agreement provides flexibility for Parties to choose the vehicles used for reporting on adaptation.

Communication of integrated information on national adaptation actions: The Regulation on the Governance of the Energy Union and Climate Action⁸⁰ sets out in Article the obligation to produce 'Integrated National Energy and Climate Progress Reports', elements of which shall include 'information on adaptation'. Article 19(1) states that "by March 2021, and every two years thereafter, Member States shall report to the Commission information on their national climate change adaptation planning and strategies, outlining their implemented actions and planned actions to facilitate adaptation to climate change, including the information specified in Part

of Annex VIII, and in accordance with the reporting requirements agreed under the UNFCCC and the Paris Agreement".

Adaptation communications shall assess a broad set of climate-related hazards, as shown in Table 2. For these hazards, assessments shall be provided in relation to:

- I. Observed impacts related to the key hazards, including changes in their frequency or magnitude.
- II. The key risks, probabilities of occurrence and levels of exposure to them.
- III. The degree of vulnerability, including adaptive capacity.
- IV. The risk of potential impacts expected in the future.

Where relevant, the secondary effects of these hazards, as well as the cascading effects and effects that may occur simultaneously, should also be considered.

	Temperature-related	Wind-related	Water-related	Solid mass-related
Chronic	Changing temperature (air, freshwater, marine water)	Changing wind patterns	Changing precipitation patterns and types (rain, hail, snow/ice)	Coastal erosion
	Heat stress		Ocean acidification	Soil degradation (including desertification)
	Temperature variability		Saline intrusion	Soil erosion
			Sea level rise	
Acute	Heat wave	Cyclone	Water shortage	Avalanche
	Cold wave	Storm (including blizzards, dust and sandstorms)	Drought	Landslide
	Wildfire	Tornado	Heavy precipitation (rain, hail, snow/ice)	Flood (coastal, fluvial, pluvial)
			Snow and ice load	Subsidence

Table 2: Classification of climate-related hazards. Based on the draft annexe on communications on national adaptation action (European Commission, 2020)

80 - Regulation UE 2018/1999

Country Profiles on the European climate adaptation platform Climate Adapt:⁸¹ "Country profiles" on adaptation include information on policy and legal framework, priority sectors, key actions developed, main legal references or monitoring system. Information on impact and vulnerability assessments carried out and research projects in the field are also presented. Finally, key aspects for involving society in adaptation are described: governance systems, education actions, training and public awareness, etc.

The information presented in the 'country profile' on adaptation is based on the information provided in the regular communications to the European Commission but it can be updated whenever relevant changes occur.

Table 3 shows the reporting timetable defined as a result of international obligations and those resulting from compliance with the PNACC, for the period 2021-2025.

	2021	2022	2023	2024	2025
PNACC monitoring reports				•	
Vulnerability and adaptation indicators	•		•		•
Climate risk report					•
National Communication (UNFCCC)		•			
Integrated communication on adaptation (EU)	•		•		•

Table 3: Planned dates for the publication of different information and monitoring documents (period 2021-2025)

10.2. EVALUATION OF THE PNACC-2

The PNACC 2021-2030 will be subject to an in-depth evaluation in 2029 in order to recognise the progress made, remaining challenges and lessons learned to date.

The evaluation will include an analysis of the plan's relevance, effectiveness, efficiency, coherence and added value. The evaluation will use a variety of sources, including

factual information (for example, levels of realization of realization of the lines of action set out in the plan), but also the assessments of individuals and organisations active or interested in the field of adaptation.

The results of this evaluation will be presented in a public report, which should contain useful conclusions and recommendations for a new planning exercise.

II. COORDINACIÓN Y GESTIÓN DEL PLAN

Adaptation to climate change calls for coordinated and coherent action by Spanish society as a whole. To this end, a system of

governance that favours the participation of all the actors involved, as well as detailed and action-oriented planning is required.

81 - <https://climate-adapt.eea.europa.eu/>

11.1. PLANNING AND PROGRAMMING

The PNACC 2021-2030 will be developed through two main programming instruments: **work programmes** and **sectoral plans**.

Work Programmes

The PNACC 2021-2030 will be developed through two Work Programmes, which will follow on from the three that have been implemented to date⁸²: the First PNACC-2 Work Programme will specify the actions to be developed in the period 2021-2025 and the Second Programme will cover the period 2026-2030.

PNACC-2 Work Programmes will:

- Detail the planned measures, within a specific timeframe, for the development of the lines of action defined in the PNACC.
- Identify, where appropriate, priority measures, taking into account the level of risk associated with the different impacts of climate change, based on the best available science, as well as the potential benefits of the proposed adaptation measures.
- Identify the organisations responsible for the development of the measures and collaborating organisations.
- Include compliance indicators with the defined measures in order to facilitate monitoring and evaluation.

NATIONAL ADAPTATION PLAN 2021-2030			WORK PROGRAMME 2021-2025		
Sectoral objective	Line of action	Compliance indicators	Key measures	Responsible parties	Compliance indicator
Provide access to the best available knowledge on future climate change scenarios and projections for all interested parties so that society can plan its responses based on reliable and up-to-date information.	L.A. 1.3. Regionalised climate change projections for Spain	Updated and accessible online projections	Regionalised projections based on the new AR6 - IPCC models	AEMET	PNACC-Scenarios data are accessible through a repository that allows downloading, taking into account good practices for the publication of scientific data.
		Operational and up-to-date scenario viewer	Operability and improvement of scenario viewer functionalities	OECC AEMET CSIC ⁸³ FB (Biodiversity Foundation, in Spanish)	The scenario viewer is operational and accessible and has been updated to reflect AR6 data and its functionalities have been improved to respond to user demands
			Working Group on PNACC Scenarios to facilitate coordination and continuous improvement	OECC AEMET CSIC FB	The PNACC-Scenarios Working Group is maintained as the governance structure for updating regionalised climate change projections and disseminating the data, and meets at least three times a year

Table 4: The PNACC 2021-2030 defines the objectives (see chapter 7) and sectoral lines of action (see annex 1), while the work programmes will identify the key measures and the units responsible for their development. The example shows the chain of objectives, lines of action and measures to make climate scenarios and projections available to interested persons.

⁸² - First work programme (WP1): 2006-2008; Second programme (WP2): 2009-2013; Third programme (WP3): 2014-2020

⁸³ - The CSIC (Superior Council for Scientific Research, in Spanish) will coordinate with other Public Research Organisations with competences in the field.

The Work Programmes will be permanently monitored in order to generate the necessary adjustments for their continuous improvement.

The Work Programmes will be adopted by Ministerial Order of the Ministry for the Ecological Transition and the Demographic Challenge or, where appropriate, the instrument that is finally indicated in the Climate Change and Energy Transition Law. The First PNACC-2 Work Programme will be prepared under the coordination of the MITERD and approved before 31 December 2020.

Sectoral and Territorial Adaptation Plans

These plans are instruments for detailed adaptation planning in specific areas of work or territories. The plans:

- Include a diagnosis of the main risks posed in the sectoral or territorial area in question
- Define objectives to be met in order to respond to the described risks
- Detail a set of measures to meet the defined objectives
- Identify the organisations responsible for the development of the measures and collaborating organisations

The Sectoral Adaptation Plans to be developed in each of the two planned programming periods for this PNACC (2021-2025 and 2026-2030) will be driven and elaborated by the competent Ministerial Departments in each case⁸⁴.

11.2. COORDINATION, ADVISORY AND PARTICIPATORY FORUMS

The coordination, advisory and participation forums envisaged in the plan are an essential element of its governance system, with the following essential objectives:

- Reinforce inter-institutional coordination, both in its intersectoral dimension (between different thematic departments) and territorial dimension (with special attention to the connection between the Central Administration - autonomous communities - local administrations).
- Facilitate participation and collaboration with social actors.
- Facilitate technical and scientific advice and exchange.

The forums will therefore make a decisive contribution to achieving the ultimate goal of the plan:

Promote coordinated and coherent action to address the effects of climate change in Spain in order to avoid or reduce present and future damage from climate change and to build a more resilient economy and society.

Orientation towards action, established as one of the hallmarks of the plan, will require the alignment of the actions of all actors that contribute directly or indirectly to the objectives, awarding a strategic role to coordination, advice and participation forums.

In order to facilitate the coordination, advice and participation in adaptation, the

⁸⁴ - As indicated in Article 15.7 of the Draft Climate Change and Energy Transition Law.

PNACC provides for a number of specific permanent forums⁸⁵:

Impacts and Adaptation Working Group (GTIA)

The GTIA is the technical exchange forum that brings together departments of the Central Administration and the autonomous communities with the general objective of coordinating and integrating the different strategies and plans for adaptation to climate change that are developed in Spain at national and autonomous community level⁸⁶.

The basic functions of the GTIA include:

- Sharing, on a regular basis, information on international policies and European policies on adaptation.
- Facilitating the exchange of information on initiatives and experiences developed by the different administrations in the field of adaptation to climate change within the scope of their competences.
- Facilitating the technical analysis of public adaptation policies.
- Generating and collecting ideas and suggestions for the improvement of public policies and measures on adaptation.

In order to ensure that the GTIA continues to play a strategic role in the technical coordination of public action on adaptation, the following actions will be developed within the framework of the First Work Programme of this plan:

- Review the composition of the GTIA with
- the aim of ensuring the participation of all Ministries and areas of public management identified in the PNACC 2021-2030.
- Ensure, whenever possible, non-presential participation modalities to facilitate greater participation in meetings.
- Improve the transparency of the body by providing information on its components and its work.

Thematic working groups may be organised within the GTIA in order to examine in depth, on a monographic basis, issues considered to be of special interest or relevance.

The Spanish Climate Change Office (OECC), in its capacity as coordinator of the PNACC, will be responsible for the technical secretariat of the GTIA.

Impacts, Risks and Adaptation Committee (CIRA)

The newly created Impacts, Risks and Adaptation Committee will bring together people from academia, non-governmental organisations, public management and business, especially SMEs, to provide ideas and recommendations for an expert judgement on adaptation in Spain.

This forum will be considered as a working group of the Committee of Experts on Climate Change and the Energy Transition,

85 - These means are in addition to and complementary to the workspaces aimed at coordinating public policies on climate change (Climate Change Policy Coordination Commission, CCPCC in Spanish) and social participation and advice (National Climate Council

and Citizens' Climate Change Assembly).

86 - Its creation was agreed in 2007 by the Climate Change Policy Coordination Commission.

foreseen in the Draft Climate Change and Energy Transition Bill. In this sense, the group will contribute to the advisory, control and supervisory functions assigned to the aforementioned body in the Law.

The Impacts, Risks and Adaptation Committee will carry out its activity with full autonomy with respect to the Central Administration and its composition will be equal in women and men.

The composition, organisation and functioning of this group will be specified in the framework of the first PNACC work programme.

PNACC Seminars

PNACC technical seminars are meeting spaces aimed at:

- Providing information to a set of key actors on the results of climate change vulnerability and impact assessment projects in a specific sector or thematic area.
- Facilitating the exchange of ideas and experiences on climate change adaptation.
- Encouraging reflection and debate on the most appropriate adaptation strategies.
- Collecting contributions of interest for the development of activities within the framework of the PNACC.

PNACC seminars will address, on a monographic basis, topics that are considered relevant at any given time for the development of the PNACC and its corresponding work programmes.

Thematic coordination groups

There are various inter-institutional coordination forums that respond to climate-related impacts and risks, including the Permanent Commission for Climate and Environmental Adversities⁸⁷, the Spanish Group on Floods⁸⁸ and the Committee against Forest Wildfires⁸⁹.

MITERD will contribute to the incorporation of the climate change adaptation perspective into the work developed by these committees, ensuring coordination and synergies with the development of the PNACC.

11.3. INTERNATIONAL COORDINATION

Adaptation to climate change is a challenge that transcends borders and benefits from international cooperation and technical exchange. The global approach to adaptation is one of the hallmarks of this plan. In this respect, the PNACC will encourage participation in the main international discussion and coordination forums.

Participation in European forums (see table 5) and other supranational forums, especially with neighbouring countries and Latin America, will be particularly promoted.

⁸⁷ - Created by Ministerial Order AAA/2272/2013 of 27 November. For more information: <https://www.mapa.gob.es/es/ministerio/servicios/analisis-y-prospectiva/Adversidades.aspx>

⁸⁸ - This group focuses on the implementation of the European Floods Directive in Spain.

⁸⁹ - The CLIF is a technical committee, made up of representatives from all administrations responsible for forest wildfires. It coordinates wildfire defence actions at a national level and has working groups on Information, Prevention, Aerial Coordination, Extinguishing Safely and others.

FORUM	MEMBERS	COORDINATION	THEMES
Working Group on Adaptation (WG6)	Technical staff of EU Member States' adaptation units	DG Climate - EC	Development of the European Adaptation Strategy
Impacts, Vulnerability and Adaptation Interest Group (EIONET)	National Focal Points of the 33 EEA member countries	European Environment Agency	Climate change impacts, vulnerability and risks
Expert Group on Adaptation (EGA)	Expert persons nominated by EU Member States	EU and EC Presidency in office	Adaptation in the international climate negotiations of the UNFCCC
Group on Adaptation of Forests to Climate Change through Sustainable Forest Management	Expert persons nominated by signatory countries and observer organisations	Ministerial Conference on the Protection of Forests in Europe (Forest Europe)	Adaptation of forests to climate change through the sustainable management of forests

Table 5: Main climate change adaptation forums at European level.

IBERIAN COORDINATION

Spain and Portugal share a specific geographical space – the Iberian Peninsula – and have territories in the Outermost Regions of the European Union, which are located in a unique biogeographical region: Macaronesia.

These circumstances mean that joint action on climate change adaptation has a very high synergistic potential between the two countries in order to address common challenges. Since 2017, in the framework of the LIFE SHARA⁹⁰ project, both countries have had a permanent coordination mechanism for the exchange of information and identification of common priorities and actions related to the shared risks associated with climate change.

As part of this mechanism, an annual meeting is conducted between the adaptation units of both countries, based within the Spanish Climate Change Office (OECC) on the Spanish side and the Portuguese Environment Agency (APA) on the Portuguese side. This formula will remain active in the period 2021-2030, and the APA and the OECC will alternately organise the annual coordination meetings.



⁹⁰ - The LIFE SHARA project (Sharing awareness and knowledge for adaptation to climate change in Spain and Portugal) was developed in the period 2016-

2021, with partners Fundación Biodiversidad, OECC, AEMET, the National Parks Autonomous Body and the Portuguese Environment Agency.

ANNEXE

I

LINES OF ACTION BY AREAS OF WORK

This annexe describes, in the form of fact sheets, the lines of action defined to develop the objectives set out in the PNACC 2021-2030. The fact sheets are arranged by areas of work, with a general introductory text for each one. In addition, Annex II includes a line of action for each of the transversal themes.

Each fact sheet contains the following sections:

- **Title**
- **Description of the line of action:** Justifies or contextualises, where necessary, the proposed line of action and describes the issues it addresses.
- **Responsible entities and collaborators:** Without prejudice to the competences corresponding to the various public administrations, it identifies some of the main bodies that will develop the measures proposed in each line over the period 2021-2030 through Work Programmes and sectoral or territorial Plans. Although it is not explicitly mentioned, the OECC, as the coordinating body of the PNACC, will collaborate in the monitoring and will provide technical support wherever needed.

It is expected that many of the actions that will serve the PNACC will involve the collaboration of different actors, such as NGOs, professional organisations, research groups, etc. This combination of collaborating entities will be finalised throughout the process of developing the plan.

- **Compliance indicator:** These are conceived as criteria to facilitate the monitoring of the development of the line of action.

- **Are regulatory instruments required?** This section identifies possible changes required in the regulatory framework for the proper development of the line of action.

- **Funding:** Where appropriate, planned funding channels are identified, without prejudice to the possibility that additional resources may be mobilised in the future. The PNACC is a basic planning instrument, and a major part of the effort to develop the proposed lines of action involves adjusting or rethinking existing lines of action to integrate adaptation, and reference is therefore frequently made to the budget of the bodies involved. However, the varied nature of climate change adaptation actions and the multiplicity of areas concerned mean that the sources of funding for the lines of action contained in this plan must also be diverse. Over the course of this plan, work will be carried out to analyse and identify other complementary instruments to those already identified, and these will be reflected in the work programmes and the sectoral or territorial plans as appropriate (more detailed information on financing can be found in Chapter 9).



I.1. CLIMATE AND CLIMATE SCENARIOS

Systematic climate observation and the generation of climate change scenarios enable us to recognise trends in climate change up to the present day and to estimate possible features of its future evolution in order to plan the most appropriate adaptive responses.

Systematic climate observation is essential for improving climate projections and for monitoring climate change (detecting trends and identifying impacts). Also, meteorological observation is also critical for disaster risk reduction, as it feeds into numerical weather prediction models and monitors adverse weather phenomena. In addition, the mass incorporation of climate-related satellite observation data adds to a better understanding of the climate system while providing information for areas where in situ observation is not available.

Climate scenarios should not be conceived as precise predictions of what will happen, but as plausible descriptions of future climate situations and their potential effects. Climate change scenarios are therefore a key element in analysing potential future climate risks in the different adaptation policy areas and facilitate decision-making when dealing with the impacts of climate change. However, the models used to generate global climate change projections do not have adequate resolution to be able to analyse the possible impacts of climate change at a regional or local scale in the natural and socio-economic spheres (ecosystems, water, agriculture, coasts, infrastructure, etc.), therefore, it is necessary to generate regionalised climate change scenarios, which allow us to appreciate the effects of climate in more specific regions or territories.

It is also essential to develop specific climate services that enable the use of climate information for decision-making. The use of Copernicus initiative climate services, of which AEMET is the national focal point, will be one of the most useful tools for climate monitoring and adaptation to climate change in the coming years.

Finally, it is essential to develop capacity building actions that ensure the dissemination and good use of the information and knowledge generated for its correct use in decision-making.

**LINE OF ACTION 1.1:
SYSTEMATIC CLIMATE OBSERVATION**

DESCRIPTION OF THE LINE OF ACTION

Addressing climate change requires a comprehensive understanding of the climate system and discernible trends over time, especially the essential climate variables (ECVs). It is therefore essential to ensure extensive and effective networks for the systematic observation of the climate in its three domains – atmospheric, oceanic and terrestrial – as well as appropriate techniques for the analysis and modelling of the data obtained. Thanks to these observational data, we now have ample evidence of the main changes that are taking place in the different components of the climate system, both globally and in Spain.

This line of action aims to ensure the sustainability of the national systematic climate observation system by maintaining and improving observation networks and Spain's contribution to global networks⁹¹, promoting the public availability of data and a selection of indicators on climate change in Spain.

In order to obtain accurate data on the evolution of the climate in Spain, it is essential to promote the coordination of observation activities in Spain, adapt operating protocols, standardise data dissemination formats, incorporate satellite information and promote citizen science climate observation initiatives.

It is proposed to strengthen Spain's contribution to global systematic climate observation networks through a national climate observation system as a contribution to the global GCOS programme, and to make the data available, in an open and interoperable format⁹² that respects good practices for the publication of scientific data.

91 - The main international network related to climate change is the *Global Climate Observing System* (GCOS) initiative, which is part of the WMO Integrated Global Observing System (WIGOS) and includes GCW (*Global Cryosphere Watch*), WHYCOS (*World Hydrological Cycle Observing System*) and GOOS (*Global Ocean Observing System*).

92 - The sources generating the data must comply with FAIR (Findable, Accessible, Interoperable and Reusable) principles.

RESPONSIBLE ENTITIES AND COLLABORATORS

AEMET, IEO (Spanish Oceanography Institute, in Spanish), OPPE (State Ports Public Agency, in Spanish), DG Water (MITERD), OAPN (Autonomous Agency for National Parks, in Spanish), FB, OECC, MAPA (Ministry of Agriculture, Fisheries and Food, in Spanish), in collaboration with the autonomous communities, universities, research centres and others.

COMPLIANCE INDICATOR

- The number of observation stations with series of more than 40 homogenised years and gaps of less than 10% in the monthly values progressively increases.
- Spain contributes regularly and systematically to the main international networks for systematic climate observation.
- Up-to-date data from systematic climate observation and a system of climate indicators is available for consultation and download.

ARE REGULATORY INSTRUMENTS REQUIRED?

Specific legislation may need to be developed to regulate Spain's contribution to global networks, determining the responsibilities of the different data source managers in their national integration.

FUNDING

Regular budget of the organisations involved and European funds.

LINE OF ACTION 1.2. WEATHER OBSERVATION FOR EARLY WARNING AND ALERT SERVICES FOR ADVERSE WEATHER AND CLIMATE EVENTS**DESCRIPTION OF THE LINE OF ACTION**

Early warning systems for adverse weather and climate events are a key adaptation measure in the context of climate change, as they aim to prepare individuals

93 - AEMET is the main body in charge of meteorological and atmospheric climatological observations; IEO and OPPE are the references in oceanographic observations; DG Water (MITERD) manages the main water observation networks; OAPN, AEMET, OECC and FB promote the Global Change Monitoring Network in National Parks, an infrastructure for in situ data collection - meteorological-terrestrial and ocean-meteorological - in the National Parks Network; and MAPA and the autonomous communities have the Agroclimatic Information System for Irrigation (SiAR) network of agroclimatic stations. Some autonomous communities also have their own observation networks and carry out monitoring work (see, for example, the Annual Bulletin of Climate Indicators produced by the Meteorological Service of Catalonia).

and communities so that they can respond in a timely and appropriate manner to hazards and thereby reduce the risk of damage. The reinforcement of these early warning systems is conditioned by the availability of adequate weather observations and forecasts that are increasingly accurate and with higher spatial and temporal resolution, as well as information communication systems that respond to the needs of those groups that have to respond to climate risks or encourage those at risk to take action.

In Spain, the State Meteorological Agency (AEMET) is in charge of weather warnings as established in the National Plan for the Forecast and Monitoring of Adverse Meteorological Phenomena (Meteoalerta). This plan aims to provide the most detailed and up-to-date information possible on adverse atmospheric events that may affect Spain, as well as to maintain continuous information on their evolution once they begin to develop. These warnings serve as a basis for the corresponding administrations to issue warnings which, in turn, trigger the adoption of measures to respond to the phenomena. It is therefore essential that there is coordination between the meteorological observation systems associated with severe weather warnings and the disaster risk preparedness system (see Line of Action 15.3 for more information).

In order to strengthen meteorological observation for early warning, work will be done to implement the WIGOS⁹⁴ system, ensuring a foundation of quality, robust and sustainable observations. The requirements for all application areas (meteorological, climatological, oceanographic) will be systematically reviewed and, depending on the actual observation capacities, the spatial and temporal resolution of the information provided in real time by the network of meteorological observatories will be increased, taking advantage of the contributions of satellite observation. Work will also continue on the identification of new variables to cover the new requirements for early warning associated with climate change, and on the appropriate communication of information on the possible impacts associated with meteorological events in order to facilitate the responses to them.

RESPONSIBLE ENTITIES AND COLLABORATORS

AEMET, with the collaboration of DGPCE (Directorate General for Civil Protection and Emergencies, in Spanish), the autonomous communities and others.

⁹⁴ - The WMO Integrated Global Observing System (WIGOS) is a framework for integrating all WMO co-sponsored observation systems into a common regulatory and management framework. The development of WIGOS focuses on ensuring that the provision and delivery of meteorological services is based on sound observations of adequate density and quality. The primary guidance on network design under WIGOS comes from the WMO Rolling Review of Requirements (RRR), in which observational data requirements for all WMO application areas are collected, analysed and recorded, and reviewed against actual and planned observational capabilities.

COMPLIANCE INDICATOR

- The spatial and temporal resolution of meteorological observations for early warning are increased, integrating other surface networks and making use of ground-based remote sensing (radar, rays, etc.) and new generations of satellite platforms.
- Observed variables for early warning associated with additional adverse events increase.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 1.3. REGIONALISED CLIMATE CHANGE PROJECTIONS FOR SPAIN**DESCRIPTION OF THE LINE OF ACTION**

The monitoring of the essential climate variables defined by the Global Climate Observing System (GCOS) provides the data required to monitor and study the climate system and to generate climate projections. These projections allow us to approximate how the climate might evolve in the future on the basis of different greenhouse gas emission scenarios (defined at international level by the IPCC) and, in this way, it is possible to detect trends in climate change and anticipate their possible effects.

Since its inception, the PNACC has produced regionalised projections for Spain (PNACC-Scenarios initiative), using the climate models employed in IPCC assessment reports. The IPCC is currently preparing its Sixth Assessment Report (AR6) which, like previous reports, will include a package of global projections, based on the models considered to be the most reliable.

This line of action involves updating, under the coordination of AEMET and, where appropriate, in coordination with Copernicus, the regionalised projections for Spain, aligned with the global scenarios and models used in the AR6 (and, where appropriate, subsequent reports) and making them freely available through the AEMET climate services website.

It also includes making regionalised climate scenarios (PNACC-Scenarios) available to all interested individuals through appropriate and versatile tools, such as scenario viewers or tools to enable the download of user-oriented data.

These tools should allow access to key variables and present data in a variety of formats, such as maps and graphs, and, where appropriate, facilitate the export of data to spreadsheets or databases.

RESPONSIBLE ENTITIES AND COLLABORATORS

AEMET, CSIC⁹⁵, OECC, FB with the collaboration of the autonomous communities, universities and research centres.

COMPLIANCE INDICATOR

- The regionalised climate change projections for the whole of Spain are updated according to the latest global models available and are published on AEMET's climate services page.
- The Climate Change Scenario Viewer is operational and updated.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 1.4. CLIMATE SERVICES

DESCRIPTION OF THE LINE OF ACTION

The generation of climate services, in collaboration with the actors involved in the planning and implementation of mitigation and adaptation initiatives, allows basic climate data and information to be transformed into specific products and applications useful for users in various fields of work.

⁹⁵ - The CSIC will coordinate with the rest of the Public Research Organisations with competences in this field.

This line of action focuses on fostering the development of climate services allowing for decision making through the production and delivery of weather and climate information useful for planning and sustainable resource management in institutional and economic sectors sensitive to weather and climate conditions. The climate services developed must respond to the needs of users and there must be an effective mechanism for accessing them. In this regard, the recommendations contained in the Implementation Plan of the Global Framework for Climate Services⁹⁶ will be adopted to coordinate, facilitate and develop climate services for operational purposes where needed.

The services to be developed will include climate services initiatives based on seasonal, inter-annual or decadal forecasting, as well as services aimed at attributing events to climate change on a national scale.

RESPONSIBLE ENTITIES AND COLLABORATORS

AEMET, CSIC⁹⁷, OECC, FB, with the collaboration of MAPA, the autonomous communities and others.

COMPLIANCE INDICATOR

- At least 10 new climate services are implemented in the period 2021-2030 in response to user demands.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 1.5. CAPACITY BUILDING IN THE USE OF CLIMATE INFORMATION

DESCRIPTION OF THE LINE OF ACTION

The actual usefulness of climate information and climate change scenarios depends not only on the quality of the information, but also on the ability of potentially interested individuals to use and interpret them correctly.

⁹⁶ - https://gfcs.wmo.int/sites/default/files/implementation-plan/GFCS-IMPLEMENTATION-PLAN-%2014211_es.pdf

⁹⁷ - The CSIC will coordinate with the rest of the Public Research Organisations with competences in this field.

The information needs to be relevant for planning the most appropriate responses to the risks associated with climate change, as well as being a key element in analysing and communicating the evolution of our climate and the need to promote ambitious climate action. To this end, specific tools have been developed for the dissemination of climate data, such as scenario viewers, which allow the visualisation and download of available data on the future climate in a simple and intuitive way.

This line of action is oriented towards the dissemination of information on available tools and capacity building for the appropriate use of tools and climate data, through the development of methodological guidelines, examples of good practices and training actions. The ultimate goal is to promote the good use of available tools and data, including the treatment of uncertainty.

RESPONSIBLE ENTITIES AND COLLABORATORS

OECC, FB, AEMET, CSIC⁹⁸, with the collaboration of MAPA, autonomous communities and others.

COMPLIANCE INDICATOR

- A specific training programme is established and developed for each work programme.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

⁹⁸ - The CSIC will coordinate with the rest of the Public Research Organisations with competences in this field.

I.2. HUMAN HEALTH

The effects of climate change on human health are multiple and complex. High temperatures, extreme weather events and changes in precipitation patterns all generate a multitude of indirect effects that impact on determinants of health such as clean air, access to clean water, food and household security and transmission of disease.

One of the impacts that has the greatest repercussions in our country is the increase in morbidity and mortality associated with extreme temperatures. Heat waves will become more frequent and intense and will have a greater effect on the most vulnerable groups of the population, such as the over 65s, children, pregnant women, people with chronic illnesses or debilitating conditions, exposed workers and people at risk of exclusion.

In addition, the increased frequency and intensity of extreme weather events can lead to human and material losses, injuries, trauma and mental health problems among the population. Torrential rainfall, flooding and droughts will all affect water quality and availability, change crop and livestock production conditions, and may increase the risk of water- and food-borne infectious diseases.

The control of infectious and parasitic diseases, both vector-borne and non-vector-borne, is another major challenge. Climate change is leading to a lengthening of the seasons in which vector-borne transmission of many infectious diseases occurs and is altering their geographical distribution, favouring their development even in territories where they did not previously exist.

Climate strongly influences the spatial and temporal distribution of atmospheric pollutants through winds, vertical mixing and precipitation, conditions that are likely to be altered by climate change. Concentrations of tropospheric ozone and particulate matter (PM_{2.5}) precursors⁹⁹ increase faster in brighter conditions and at higher ambient temperatures, so climate change tends to increase them.

All this demonstrates the need to implement adaptation measures to reduce the impacts of climate change on health. Considering that the adaptive capacity of human physiology has limits, the measures also need to be accompanied by ambitious mitigation measures which, in addition to contributing to mitigating the effects of climate change, produce enormous co-benefits for health.

⁹⁹ - PM_{2.5} are airborne particles smaller than 2.5 micrometres.

The human health area of work is closely related to other areas of work in the PNACC, particularly 3 (water and water resources), 4 (biodiversity and protected areas) and 6 (agriculture, livestock, fisheries and aquaculture)¹⁰⁰. In this sense, integrative visions, such as the One Health initiative, aimed at increasing communication and interdisciplinary collaboration in the healthcare of people, animals and the environment, with the understanding that they are all interlinked, are of value.

LINE OF ACTION 2.1. INTEGRATING CLIMATE CHANGE INTO THE NATIONAL HEALTH AND ENVIRONMENT PLAN

DESCRIPTION OF THE LINE OF ACTION

The National Health and Environment Plan will describe the main environmental factors that influence human health and will establish the objectives and lines of intervention of the National Health System in this area.

This plan will develop Law 33/2011, of 4 October, General Law on Public Health, and commitments with the European Union and the international bodies responsible for health and the environment, especially WHO, UN, 2030 Agenda and Sustainable Development Goals. It will define the most effective, flexible and multidisciplinary preventive intervention mechanisms adapted to new environmental risks.

Climate change generates diverse impacts on the health of the Spanish population, aggravating existing health risks or creating new ones (for example, by altering the geographical distribution of vector-borne diseases). For this reason, the effects of climate change, already observed or foreseeable, will be incorporated into the National Health and Environment Plan in its various dimensions: extreme temperatures, air quality, natural disasters, sanitary quality of water and food, and disease-transmitting vectors.

Some of the main lines of intervention to be addressed by the plan include:

- Prevention and health protection, with the challenge of reducing the morbidity and mortality associated with climate change
- Research to improve knowledge on the health impacts of climate change and the effectiveness of adaptation measures
- Training and risk communication to improve the knowledge of both health professionals and the general public

¹⁰⁰ - An estimated 60% of human pathogens are of animal origin (zoonoses) and an average of five new diseases dangerous to humans appear each year, many of them via cross-species transmission from animals.

- Monitoring, evaluation and use of indicators
- Management, organisation and coordination of actions among the actors involved, with the creation of the Health and Climate Change Observatory being a highlight.

RESPONSIBLE ENTITIES AND COLLABORATORS

Ministry of Health and MITERD, with the collaboration of AEMET.

COMPLIANCE INDICATOR

- Climate change risks are addressed in the National Health and Environment Plan, which remains operational throughout the period 2021-2030.
- The Health and Climate Change Observatory is fully operational and is an instrument for the analysis, diagnosis, evaluation and monitoring of the effects of climate change on public health and the National Health System.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 2.2. PREVENTIVE ACTIONS AGAINST THE EFFECTS OF EXCESSIVE TEMPERATURES ON HEALTH

DESCRIPTION OF THE LINE OF ACTION

Since 2004, the National Plan of Preventive Actions on the Effects of Excessive Temperatures on Health has organised and guided the measures aimed at avoiding the impacts of excessive heat on health in Spain.

The success of this plan is based on good coordination between meteorological services (which prepare heatwave forecasts), health services (which develop action protocols and recommendations), social services (which provide care to the sectors most vulnerable to the phenomenon) and civil protection authorities (which ensure an adequate response to possible emergencies), as well as on the existence

of a sound scientific basis, which includes the identification of the temperature thresholds that trigger heat-related mortality in different areas of Spain.¹⁰¹

This plan, which has contributed to reducing mortality associated with high temperature events in Spain,¹⁰² is a good example of the benefits of good coordination between public services, as well as the need to base health protection initiatives on the best available science.

Regionalised climate change projections for Spain suggest that heatwave episodes will become longer, more frequent and more intense, which justifies the future maintenance of this plan, introducing the necessary modifications each year to improve its effectiveness.

RESPONSIBLE ENTITIES AND COLLABORATORS

Ministry of Health, with the collaboration of MITERD, DGPCE (MIR, Ministry of the Interior, in Spanish), regional health and emergency departments and health and social services at local level.

COMPLIANCE INDICATOR

- The National Plan of Preventive Actions on the Effects of Excess Temperatures on Health will remain operational throughout the period 2021-2030.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

¹⁰¹ - Instituto de Salud Carlos III (2015). *Temperaturas umbrales de disparo de la mortalidad atribuible al calor en España en el periodo 2000-2009*. Ed. Instituto de Salud Carlos III, Ministerio de Economía y Competitividad

¹⁰² - Diaz, J. et al. (2018). Time trend in the impact of heat waves on daily mortality in Spain for a period of over thirty years (1983–2013). *Environment International*, 116: 10–17

LINE OF ACTION 2.3. PREPARATION AND RESPONSE TO INFECTIOUS AND PARASITIC DISEASES DRIVEN BY CLIMATE CHANGE

DESCRIPTION OF THE LINE OF ACTION

Climate change favours the spread of a number of vector-borne and non-vector-borne infectious and parasitic diseases.

The National Preparedness and Response Plan for Vector-borne Diseases,¹⁰³ already addresses Dengue, Chikungunya and Zika, all of which are transmitted by *Aedes* mosquitoes, which are expanding in Spain due to climate change.

The plan, coordinated by the Ministry of Health, is structured around six key elements: epidemiological and microbiological surveillance to detect, diagnose and treat all patients as quickly as possible; entomological surveillance to detect the presence of the vector; vector management to prevent and control its presence and, if possible, eradicate it; individual protection of the population; training and information and, if necessary, research; as well as coordination and communication between the administrations and agents involved, without which the activities contemplated in the plan could not be carried out.

These actions should be applied to new diseases or vectors favoured by climate change, if considered relevant threats. Diseases already present in some areas of Spain that will require attention in this regard include leishmaniasis, tularaemia, Crimean-Congo haemorrhagic fever, West Nile fever and Lyme disease, and among the vectors, ticks and other species of mosquito.

It is also worth highlighting the interest of citizen science initiatives for the evaluation and control of the presence of the vectors that cause these diseases.

RESPONSIBLE ENTITIES AND COLLABORATORS

Ministry of Health, with the collaboration of regional health departments and local health and environment services.

¹⁰³ - Approved by the Public Health Commission of the Interterritorial Council of the National Health System in April 2016, available at: https://www.mscbs.gob.es/profesionales/saludPublica/ccayes/alertasActual/DocsZika/Plan_Nac_enf_vectores_20160720.pdf

COMPLIANCE INDICATOR

- Plans for the prevention and control of the indigenous transmission of Dengue, Chikungunya and Zika remain operational for the period 2021-2030.
- A nationwide vector-borne disease surveillance network is consolidated, integrating human and animal epidemiological surveillance and entomological surveillance.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 2.4. PREVENTIVE ACTIONS AGAINST EPISODES OF ATMOSPHERIC POLLUTION

DESCRIPTION OF THE LINE OF ACTION

In a large part of the Spanish territory, climate change could favour the persistence of stable atmospheric conditions that hinder the dispersion of primary pollutants in urban areas, aggravating air pollution, especially concentrations of nitrogen oxides and particulates.

In addition, high temperatures and increased sunshine hours lead to increased levels of tropospheric ozone, a secondary pollutant whose formation is enhanced under these conditions and which has an added impact on health.

Climate change could also lead to increased desertification and the generation of desert dust storms, which adversely affect air quality.

It is important to bear in mind that the risk factors mentioned above are interrelated: atmospheric stagnation, high temperatures and radiation frequently coincide in time and generate high levels of NO₂, PM and O₃, with the consequent simultaneous increase of various pollutants. Heat waves often coincide with the arrival of dust from the Sahara. On days when the Saharan air mass over Spain extends over a significant range of altitudes and is heavily laden with desert dust particles, there is less sunshine and, therefore, a decrease in the 100 height of the

mixing layer.¹⁰⁴ This leads to a lower dispersion of pollutants at the surface and to an increase in concentrations, not only of particulate matter but also of primary pollutants such as NO₂. Furthermore, the arrival of dry and very warm air produces an increase in temperature, favouring the formation of tropospheric ozone.

Climate change is ultimately an aggravating factor for air pollution episodes in cities and areas with affected air quality, with potentially increasing health impacts.

This line of action aims to organise preventive actions, from a public health perspective, through the approval of a National Plan that organises responses to atmospheric pollution episodes from an integrated perspective. In this regard, the influence of climate change on air pollution levels, especially in large cities, should be analysed, taking into account:

- The interaction between temperature and pollution, in particular during periods of extreme heat, and its impact on health.
- The climatic evolution of the blocking anticyclones foreseen by different climate scenarios and their impact on the dispersion of pollutants and the formation of tropospheric ozone.

Considering the potential coincidence of specific episodes of various damaging factors (high temperatures, air pollution, atmospheric dust), the feasibility of defining integrated indices for the incorporation into early warning systems will be studied.

RESPONSIBLE ENTITIES AND COLLABORATORS

Ministry of Health, with the collaboration of MITERD and ISCIII (Carlos III Health Institute, in Spanish), regional health and emergency services and local authorities.

COMPLIANCE INDICATOR

- A National Plan of Preventive Actions for episodes of atmospheric pollution, which addresses the influence of climate change and limits the effect on health, is approved.

104 - The mixing layer is the layer of air through which pollutants released from the earth's surface are transported and diffused through the atmosphere. As such, emissions occurring in the lower layers are retained in a volume of air whose vertical dimension is delimited by the height of the mixing layer. Consequently, there is a close relationship between air pollution rates and the depth of this layer of air.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved and European funds.

LINE OF ACTION 2.5. PREVENTIVE ACTIONS AGAINST THE EFFECTS OF CLIMATE CHANGE ON WORKERS' HEALTH

DESCRIPTION OF THE LINE OF ACTION

Climate change exacerbates existing occupational hazards and poses new ones. Extreme weather events pose a risk in certain areas of work, making it necessary to take measures to adapt to the effects of climate change. Ambient temperatures are a clear example, as they alter attention and cause discomfort, which can eventually lead to accidents at work.¹⁰⁵

In the short term, high temperatures can lead to heat illness (including heat stroke). In the long term, repeated exposure to high temperatures may contribute to the aggravation of chronic diseases and pose a risk to pregnancy. In addition, heat increases the toxicity of certain substances and reduces the effectiveness of personal protective equipment in reducing risk.

There are many occupations in which, in addition to high ambient temperatures, workers are exposed to other factors that have the capacity to alter the body's thermal balance: work near heat sources (for example, kitchens, ovens), work that requires moderate or intense physical exercise, or work that requires the use of clothing or personal protective equipment that hinders normal perspiration. Furthermore, people working outdoors are directly exposed to high ambient temperatures, to which radiant heat (mainly solar) is added and, in urban environments, the urban heat island effect.¹⁰⁶

105 - For Spain, a study has concluded that extreme cold increases the risk of occupational accidents by 4%, while extreme heat increases it by 9%: Martínez-Solanas, E. et al. (2018). Evaluation of the Impact of Ambient Temperatures on Occupational Injuries in Spain. *Environmental Health Perspectives*. Vol. 126, no 6, June.

106 - María-Tomé, B. (2019). *Saludapt: La adaptación y la protección de la salud ante el cambio climático. Catálogo de experiencias y buenas prácticas en administraciones públicas y empresas*. Instituto Sindical de Trabajo, Ambiente y Salud.

Preventing the effects of climate change on health in the workplace requires the inclusion of climate change factors in workplace risk assessments and the subsequent planning of preventive measures, as well as the promotion of specific programmes to protect the most vulnerable groups of workers.

Although this is an indirect consequence of climate change, it will also be necessary to assess occupational risks related to new jobs or occupational areas associated with climate change adaptation.

RESPONSIBLE ENTITIES AND COLLABORATORS

Ministry of Health, with the collaboration of INSST (National Institute for Occupational Safety and Health, in Spanish - MITRAES) and MITERD, and the participation of representative business and trade union organisations.

COMPLIANCE INDICATOR

- A National Plan of Preventive Actions against the effects of climate change on workers' health is approved.
- Recommendations are developed to help companies identify the potential impacts of climate change on workers' health and incorporate prevention measures.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

I.3. WATER AND WATER RESOURCES

Climate change projections, despite their high degree of uncertainty regarding precipitation, point to a progressive reduction of water resources in Spain. In the worst-case scenario, an approximately 24% reduction in average river flow is forecast for the end of the century with respect to the reference series 1961-2000, possibly increasing to between 30 and 40% in the most sensitive areas.¹⁰⁷ The reduction in aquifer recharge is estimated in similar proportions.

All studies also predict an increase in climate variability, with a significant alteration of temporal and spatial patterns of precipitation. This points to an expected increase in the risk of droughts, which will be more frequent, longer and more intense, and floods, with more frequent swells and higher peak flows.

Episodes of torrential rain may be accompanied by geomorphological imbalances in basins, which may lead to a more accelerated siltation of reservoirs, with the consequent reduction in their capacity, accentuated by the need for flood mitigation measures. Rising temperatures will also increase evaporation losses from reservoirs, which could double in the coming decades. Furthermore, hydraulic infrastructures have been designed with safety margins that, in some cases, could be exceeded due to the effects of climate change.

The increase in evapotranspiration due to the effect of temperature, together with the possible extension of the irrigation season, could lead to increases in demand for irrigation and agricultural uses, which already account for more than 70% of total demand in Spain. In addition to agriculture, the energy sector is highly vulnerable due to its dependence on water availability.

Water quality and aquatic ecosystems will also be significantly affected by the effects of climate change. Increased temperatures and reduced flows will favour eutrophication processes and increase the concentration of pollutants. The reduction of dissolved oxygen in waters, due to increased temperatures and eutrophication processes, will endanger the living conditions of many aquatic species. Also, increased torrential rainfall will be accompanied by the entrainment of sediments and pollutants and, additionally, sea level rise will favour saline intrusion processes in coastal areas.

¹⁰⁷ - CEDEX (2017). Evaluación del impacto del cambio climático en los recursos hídricos y sequías en España. Centro de Estudios y Experimentación de Obras Públicas. Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente.

In a country that already uses water intensively, it is essential to respond to the new pressures arising from climate change and to manage usage priorities by proposing concrete policies and actions to strengthen the integrated management of water and territory. The challenge is crucial because, without adequate intervention, water security for socio-economic activities and ecosystems cannot be guaranteed, moving us towards a structural water crisis. Savings, reuse of reclaimed water and desalination together with the use of renewable energies can facilitate adaptation to climate change.

LINE OF ACTION 3.1. EXPANDING AND UPDATING KNOWLEDGE ON THE POTENTIAL IMPACTS OF CLIMATE CHANGE ON WATER AND THE MANAGEMENT OF WATER RESOURCES

DESCRIPTION OF THE LINE OF ACTION

River basin management plans (PHCs, in Spanish) already incorporate the assessment of the potential effect of climate change on the natural water resources of each district, as established in the Hydrological Planning Regulation.¹⁰⁸ At present, the estimation of water resources is carried out considering different climate scenarios for a time horizon of two additional planning cycles to that of the plan itself (i.e. 18 years). As such, the water resources plans that will be reviewed at the end of 2021 will assess the effects of climate change on water resources according to 2039 forecasts when considering the allocation and reservation of resources for 2027.

However, the effects of climate change extend beyond the availability of water resources, affecting other relevant aspects of water management, such as water uses, the quality of water and ecosystems, and the probability of occurrence of extreme events, and these effects must be considered in water resources planning and management.

The impact assessment studies carried out to date should also be periodically updated in accordance with the new regionalised climate projections¹⁰⁹ for Spain based on the global models and scenarios of successive IPCC reports.

In this line, the following studies will be developed and/or updated:

¹⁰⁸ - Royal Decree 907/2007 of 6 July 2007, approving the Hydrological Planning Regulation, establishes this obligation in article 11.4.

¹⁰⁹ - Link with Line of Action 1.3.

- Effects of climate change on water resources.
- Effects of climate change on extreme events (droughts and floods).
- Effects of climate change on water uses.
- Effects of climate change on the status of water bodies and associated aquatic ecosystems.

In terms of potential impacts on water bodies and aquatic ecosystems, the following aspects need to be further explored: displacement of the thermal barrier of cold water species, reduction of dissolved oxygen content in water due to increased temperature, changes in the value of biological indices¹¹⁰ due to increased temperature, effect on the life cycle of species due to changes in the hydrological regime, conversion from permanent to ephemeral ecosystems due to reduced groundwater inputs, increased concentration of pollutants in water due to reduced natural inputs, increased eutrophication due to greater concentrations of pollutants and increased temperature, flooding of coastal wetlands and consequent displacement of the salt wedge in groundwater, displacement of habitats of the natural species in the drainage basin and impacts on riverbank vegetation.

Improving knowledge in these areas will enable the work carried out in support of river basin management plans to be expanded, serving as a basis for more exhaustive risk assessments by river basin district that will enable progress to be made in defining long-term adaptation strategies.¹¹¹ These studies will serve as a reference for the development of risk assessment work and the adoption of adaptation measures at regional and local level.

Moreover, given the heterogeneity of results provided by different models, in the future, it will be necessary to analyse the degree of suitability of the selected models and, probably, to increase their number. Subsequently, considering the results of the projections, it will be necessary to integrate uncertainty analysis into resource allocation mechanisms.

RESPONSIBLE ENTITIES AND COLLABORATORS

OECC and DG Water (MITERD), with the collaboration of AEMET, DG Coast and Sea (MITERD).

¹¹⁰ - Biological indices are parameters for assessing the ecological status of water bodies, through the use of organisms or biological communities that respond to pressures on the aquatic environment.

¹¹¹ - Link with Line of Action 3.2.

COMPLIANCE INDICATOR

- Updated studies are available to assess the effects of climate change on water resources, extreme events, water uses and the status of water bodies and associated aquatic ecosystems, according to the latest available climate models and scenarios.

ARE REGULATORY INSTRUMENTS REQUIRED?

Possible adjustment of the Hydrological Planning Regulation and Instruction.

FUNDING

Regular budget of the organisations involved, PIMA Adapta and other sources of funding.

LINE OF ACTION 3.2. INTEGRATION OF CLIMATE CHANGE ADAPTATION INTO WATER PLANNING AND INTEGRATED WATER CYCLE MANAGEMENT**DESCRIPTION OF THE LINE OF ACTION**

River basin management plans generally consider relevant aspects for water management, such as the conditions on the guarantee with which the different types of water demand (urban, agricultural, livestock, industrial, etc.) can be met; however, it has not yet been technically possible to quantitatively assess the effects of climate change on these and other very relevant aspects of water management plans, such as those related to the status of water bodies.

Work to expand and update knowledge on the potential impacts of climate change on water management¹¹² will allow for further integration of climate change adaptation into water planning.

Considering the effects of climate change on water resources, extreme events, water uses, water quality and the condition of aquatic ecosystems, river basin management plans will include a risk assessment for each river basin district based on the results of the above-mentioned studies. This should contain at least a medium-term risk estimate for:

¹¹² - Link with Line of Action 3.1.

- Water guarantees
- Environmental objectives
- Water infrastructures

Based on the results of this assessment, long-term objectives for risk reduction will be defined and an adaptation strategy will be developed at district level, incorporating anticipatory, planned, coordinated and contingent adaptation measures aimed at meeting these objectives.

As far as possible, the adaptation measures will be subject to a cost-benefit analysis, with priority being given, in any case, to measures aimed at saving water and reducing consumption, diversifying water resources, improving the condition of bodies of water and aquatic ecosystems, improving ecological connectivity, adapting hydraulic infrastructures (regulation, distribution, sanitation, purification, desalination, etc.) to the new scenarios, and energy efficiency, incorporating renewable energies into the joint scheme for water and energy use, as a means of reducing the operating costs of generating and transporting resources such as regenerated and desalinated water. An integrated water and land management perspective will be sought when developing adaptation measures, enhancing coordination with territorial planning.

For their part, regional and local administrations will promote risk assessment work and climate change adaptation strategies under their respective remits.

RESPONSIBLE ENTITIES AND COLLABORATORS

Basin organisations, autonomous communities through intra-community basin plans, DG Water with the support of OECC, DG Coast and Sea (MITERD).

COMPLIANCE INDICATOR

- Fourth planning cycle of river basin management plans (2027-2033) contain a climate change risk assessment and a long-term adaptation strategy for the district.

ARE REGULATORY INSTRUMENTS REQUIRED?

Legal instruments may be needed to concretise obligations on risk assessment and adaptation strategies in river basin water planning.

FUNDING

Regular budget of the organisations involved and other sources of funding.

LINE OF ACTION 3.3. CONTINGENT DROUGHT RISK MANAGEMENT INTEGRATED INTO WATER PLANNING AND MANAGEMENT

DESCRIPTION OF THE LINE OF ACTION

The management of risks associated with droughts in Spain is carried out through Drought Management Plans (PESs, in Spanish), in response to the obligation in the Water Resources Plan Law to lay the foundations for planned drought management in inter-community basins. Although it is not compulsory for intra-community basins, many of them also draw up their respective PES.

Following their latest revision, the PESs incorporate aspects such as climate change, and a distinction is made between situations of drought, caused by a reduction in precipitation, and situations of scarcity, understood as a problem in meeting demand and which is, therefore, dependent on human activity. Through the use of indicators and the definition of territorial management units, a diagnosis of the situation is made, which facilitates decision-making for the management of situations of prolonged drought and short-term scarcity.

In this line, the aim is to reinforce the role of river basin management plans in the management of structural scarcity, understood as a chronic problem in meeting demand with the available resources, which must be fully differentiated from the management of short-term scarcity. Under no circumstances should structural scarcity be solved by short-term measures that jeopardise the sustainability of the resource.

For this reason, after carrying out risk assessment work,¹¹³ river basin authorities will promote long-term contingent adaptation measures that will effectively adjust the exploitation rates in each district, providing the necessary margins and capacity to respond to episodes of drought. In this context, measures for saving and efficiency in the use of the resource will be promoted, aimed at reducing the net consumption of consumptive water use. Protecting groundwater will be a priority for their use as a strategic resource during these episodes.

In any case, coordination between both planning instruments (PESs and PHCs) and the integration of adaptation to climate change into them should be ensured, taking as a reference the fact that all studies predict an increase in the frequency, duration and intensity of droughts.

The assessment of the environmental and socio-economic impacts of droughts should be systematised and standardised to verify whether progressive mitigation is achieved.

¹¹³ - Link with Line of Action 3.2.

For their part, regional and local administrations will promote contingent adaptation measures to deal with drought, from their respective areas of competence, in line with hydrological planning instruments.

RESPONSIBLE ENTITIES AND COLLABORATORS

River basin authorities, autonomous communities through intra-community basin plans, DG Water (MITERD), with the collaboration of OECC, IGME and AEMET.

COMPLIANCE INDICATOR

- Exploitation rates in basins with excessive values are reduced.
- The added environmental and socio-economic impacts of drought associated with climate change are reduced.

ARE REGULATORY INSTRUMENTS REQUIRED?

The concept of drought and its regulation are practically unmentioned in the Consolidated Text of the Water Law. There are also gaps in its implementing regulation that could be addressed.

FUNDING

Regular budget of the organisations involved and other sources of funding.

LINE OF ACTION 3.4. COORDINATED AND CONTINGENT FLOOD RISK MANAGEMENT

DESCRIPTION OF THE LINE OF ACTION

Floods are the most damaging natural hazard, both material and in terms of loss of human life, in Spain. Their management is carried out through flood risk management plans (PGRIs, in Spanish), whose elaboration process includes a preliminary risk assessment, the identification of the areas at highest risk of flooding and the preparation of hazard maps, with the calculation of flood zones, and risk maps, which consider land uses and the main foreseeable damages.

Although there is great uncertainty in climate projections concerning maximum and extreme precipitation, work is being done to incorporate the influence of climate change on flood risk in the second planning cycle of the PGRIs.

Updated studies assessing the effects of climate change on floods,¹¹⁴ will allow for a more comprehensive risk assessment and the definition of contingent adaptation strategies.

Among the adaptation measures to address flood risk, priority will be given to actions aimed at the recovery of the natural morphology and dynamics of watercourses and the promotion of nature-based solutions (NbS), which foster co-benefits for other objectives such as the conservation status of ecosystems, the protection of water quality, the recharge of aquifers and ecological connectivity. Wherever possible, cost-benefit analyses will be used to prioritise actions.

Flood risk management brings together many areas of public management, such as weather forecasting, urban and land-use planning, civil protection and early warning, management of the public water domain and management of the public maritime domain, which are competences exercised at different levels of government. For this reason, coordination and coherence in the establishment of adaptation objectives are key in the management of this type of extreme event, which are expected to increase in frequency and intensity.

Flood risk management planning must in turn be aligned with PHCs, promoting the development of contingent actions for flood risk reduction in a coordinated manner.¹¹⁵

RESPONSIBLE ENTITIES AND COLLABORATORS

River basin authorities, autonomous communities through intra-community basin plans, DG Water (MITERD), OECC, DG Coast and Sea (MITERD), AEMET, DGPCE (MIR), autonomous communities and local authorities.

COMPLIANCE INDICATOR

- PGRIs integrate the effects of climate change in the management of flood risk and contain adaptation measures consistent with river basin management plans. They are produced in full coordination with all actors involved.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved, PIMA Adapta and European funds.

¹¹⁴ - Link with Line of Action 3.1.

¹¹⁵ - Link with Line of Action 3.5

LINE OF ACTION 3.5. ACTIONS TO IMPROVE THE CONDITION OF WATER BODIES AND AQUATIC ECOSYSTEMS, WITH AN IMPACT ON GROUNDWATER

111

DESCRIPTION OF THE LINE OF ACTION

Achieving and maintaining the good status of water bodies and their associated ecosystems, in line with the objectives of the Water Framework Directive, reduces their vulnerability to the effects of climate change. Water is an essential element for the structure and functioning of ecosystems. These, in turn, depending on their structure and state of conservation, carry out essential functions in regulating the hydrological cycle at all levels and across all phases.

The impacts and risks of climate change on water resources go beyond the availability of water in sufficient quantity and quality, and water management must be approached from a holistic and integrated perspective. In this sense, basin adaptation strategies developed to reduce the risks of climate change¹¹⁶ should prioritise actions to improve water quality, reinforcing waste water treatment actions and the control of point-source and diffuse pollution, together with the definition of adequate flow regimes, which prevent lack of flow from affecting water quality and wildlife conservation, a situation that will be aggravated by climate change.

The recovery of the morphology and dynamics of watercourses also plays a key role in hydrological regulation. Therefore, actions such as recovering meanders, reconnecting flood plains, renaturalising watercourses, preserving wetlands, eliminating obstacles, promoting continuity, and recovering riverside forests should be promoted. These actions perform multiple functions and offer co-benefits such as reducing flood risk, improving biodiversity and the conservation status of ecosystems, recharging aquifers, protecting quality, reducing erosion and improving soil structure.

The protection of groundwater must be a priority, not only because it is the most vulnerable resource, due to the deterioration of its quality and overexploitation, but also, because it is a strategic resource for water management in situations of drought. It plays a fundamental role in the maintenance of aquatic ecosystems, providing the base flow of river systems, and its deterioration jeopardises the environmental status of rivers and the sustainability of their water supply and flow maintenance services. For all these reasons, the recovery of groundwater bodies is a priority objective in terms of adaptation. The reduction of groundwater abstractions should be promoted where sustainability limits are exceeded, and the effective reduction of pollution should be encouraged, particularly that related to agricultural and livestock farming.

116 - Link with Line of Action 3.2.

RESPONSIBLE ENTITIES AND COLLABORATORS

River basin authorities and DG Water (MITERD), autonomous communities through intra-municipal basin plans, with the support of the OECC, DG Coast and Sea (MITERD) and IGME.

COMPLIANCE INDICATOR

- The number of actions aimed at improving the conditions of water bodies and associated aquatic ecosystems, as well as the budgets for their implementation are increased.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved, PIMA Adapta and other sources of funding.

LINE OF ACTION 3.6. MONITORING AND IMPROVING KNOWLEDGE OF THE OBSERVABLE EFFECTS OF CLIMATE CHANGE ON WATER BODIES AND THEIR USES**DESCRIPTION OF THE LINE OF ACTION**

Anticipating the impacts of climate change requires building an information and analysis system to monitor the evolution of the observable effects, and being prepared for events as they occur.

The characterisation and monitoring of the status of water bodies is essential in order to verify compliance with the different objectives of water, climate change and ecosystem planning.

In this sense, in addition to rigorously maintaining the networks for monitoring the status of different water bodies, it is also necessary to continue to advance in the characterisation of the effects of climate change on them. Their continuous monitoring and evaluation, both quantitative (river flows, aquifer levels) and qualitative (status of water bodies), must be integrated into the national climate observation system.¹¹⁷

It is also of vital importance to maintain real-time hydrological information networks for many reasons including their key role in generating early warnings

¹¹⁷ - Link with Line of Action 1.1

for flood risk management, as well as water quality information systems as a preventive measure for the health of the population.

It is also necessary to monitor the evolution of significant pressures including those related to the different types of water use, both due to extraction and its related hydromorphological effects, and the return of waste water, leachates, surplus water, etc.

Real knowledge on the usage of water in Spain is essential for the design of effective and realistic adaptation strategies, which should address the strict control of usages within the framework of the current concession regime and legality. For this reason, the improvement of knowledge on the existing concession regime should be promoted, including information on real consumption and existing rights, network losses, degree of purification, irrigation returns, reuse, desalination, etc.

Therefore, in order to advance decision-making and knowledge-based adaptation strategies, climate change monitoring systems should integrate the following instruments:

Network for monitoring the effects of climate change on water bodies, especially those not altered by direct human action. Hydrological Reserves will be considered as special elements for monitoring.

- Network for monitoring the condition of all water bodies (quality and quantity).
- Central Water Database in coordination with water registers kept by river basin authorities , with real information on the existing concession regime.
- Drinking Water Quality Information System (SINAC, in Spanish).
- Bathing Water Quality Information System (NÁYADE, in Spanish).

RESPONSIBLE ENTITIES AND COLLABORATORS

River basin authorities , autonomous communities for intra-community river basin management plans, DG water (MITERD), with the support of OECC, DG Coast and Sea (MITERD) and the Ministry of Health.

COMPLIANCE INDICATOR

- An up-to-date hydrological information system and systematic observation data on the effects of climate change on water bodies are available.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved, PIMA Adapta and other sources of funding.

I.4. NATURAL HERITAGE, BIODIVERSITY AND PROTECTED AREAS

Spain is one of the most biologically diverse countries in the European Union. Its geographical position, its rich geological diversity, the great variability of climates, reliefs and soils, the palaeobiogeographical history and the existence of islands are some of the factors that have led to this high biological diversity.¹¹⁸

Climate change is already having an impact on biodiversity, from the genetic level through to the ecosystem. And the risk is increasing due to the accelerating pace of changes in the distribution of species, changes in phenology, altered population dynamics and changes in the overall composition of species and ecosystem structure and function, affecting marine, terrestrial and freshwater systems.

Climate change also multiplies threats to biodiversity by combining with other drivers of global change. Ecosystem fragmentation is a serious threat to the conservation of entire ecological processes. Limits to the free movement or propagation of biological organisms are a problem with serious negative impacts on biodiversity, especially in the context of climate change. Furthermore, climate change favours the colonisation processes of invasive exotic species, which are one of the main causes of biodiversity loss in the world. Also, certain changes in land use and their interactions with climate change pose a serious threat to biodiversity.

In marine and coastal systems, climate change impacts such as sea level rise, acidification, loss of calcifying species and changes in primary productivity have consequences such as habitat reduction, geographic shift of associated species and widespread losses of biodiversity and ecosystem functionality.¹¹⁹

The effects of climate change are also felt on geological heritage, since certain processes (erosion, sedimentary, subsidence, precipitation, dissolution, etc.) that condition the evolution of geological elements are affected by climate change, and their degradation may be accelerated.

Adaptation through nature-based solutions (NbS) can reduce the risks of climate change on biodiversity and provide multiple additional benefits such as carbon

118 - The number of vascular plants present in Spain, for example, exceeds 8,000 species, of which some 1,500 are endemic. This accounts for about 85% of the vascular plant species inventoried in the European Union and half of the European endemic species. With regard to animal species, approximately half of the estimated 142,000 in Europe are cited in Spain.

119 - Kersting, D. (2016). Cambio climático en el medio marino español: impactos, vulnerabilidad y adaptación. Oficina Española de Cambio Climático, MAGRAMA, Madrid, p. 166.

storage, improved water quality, protection of human health, biodiversity conservation and livelihood support.

As cited in the Global Assessment Report on Biodiversity and Ecosystem Services (IPBES, 2019), in order to achieve the Sustainable Development Goals and the 2050 Vision for Biodiversity, new targets will be more effective if they are defined with climate change impacts in mind.

LINE OF ACTION 4.1. INCORPORATION OF CLIMATE CHANGE INTO NATIONAL CONSERVATION STRATEGIES¹²⁰ AND CONSERVATION AND RECOVERY PLANS FOR ENDANGERED SPECIES¹²¹

DESCRIPTION OF THE LINE OF ACTION

Law 42/2007, of 13 December 2007, on Natural Heritage and Biodiversity establishes the obligation to approve conservation strategies for endangered species present in more than one autonomous community, or those species that are key to the functioning of ecosystems present in more than one autonomous community. It also provides for the approval of recovery or conservation plans to improve the conservation status of taxa or populations included in the "Endangered" or "Vulnerable" categories, respectively, of the Spanish Catalogue of Endangered Species, paying special attention to species declared "Critically Endangered".¹²²

These instruments must include guiding criteria and the most appropriate measures for the fulfilment of the objectives sought for each species and, where appropriate, the designation of critical areas. However, for various reasons – such

120 - Article 60.1 of Law 42/2007, of 13 December, on Natural Heritage and Biodiversity, establishes that National Conservation Strategies will be drawn up for the most endangered species and those that are key to the functioning of ecosystems.

121 - Article 54.1 of Law 42/2007, of 13 December, on Natural Heritage and Biodiversity establishes that: "The Central Administration and the autonomous communities, within the scope of their respective competences, shall adopt the necessary measures to guarantee the conservation of biodiversity living in the wild, giving priority to the preservation of their habitats and establishing specific protection regimes for those wild species whose situation so requires...". With the aim of detailing which species these are, the law creates the List of Wild Species under Special Protection Regime and, within it, the Spanish Catalogue of Threatened Species, both developed by Royal Decree 139/2011, of 4 February.

122 - Article 60.2 of Law 42/2007, of 13 December, on Natural Heritage and Biodiversity, establishes the possibility of declaring species with this legal status. The first declaration of species in a critical endangered situation was made through Order TEC/1078/2018, of 28 September, declaring the works and projects aimed at the recovery of these taxa to be of general interest.

as the lack of sufficient information on the climatic niches of species – climate change is often not sufficiently factored into these strategies and plans.

The aim of this line of action is to contribute to overcoming these barriers so that the strategies and plans for listed species are carried out and/or updated, taking into account the requirements imposed by the current context of climate change, reducing its impact on these species and increasing their resilience.

Early work to analyse changes in the distribution areas of species based on climate change projections point to a considerable increase in the number of threatened species, with more species facing less suitable climatic conditions or reduced distribution areas, as opposed to those with an increased potential distribution area or benefiting from more favourable conditions. For this reason, it is also important to update the studies on the potential distribution of wild species and their key habitats, using the most recent climate models provided by the IPCC, so that the information provided can be used to manage biodiversity in a more complete and sustained manner over time.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, autonomous communities.

COMPLIANCE INDICATOR

- Conservation Strategies and conservation and recovery plans for listed species (new or updated) incorporate appropriate measures for their conservation in the face of the expected effects of climate change.
- Conservation actions carried out for listed species include the implementation of appropriate measures on the ground to improve their conservation in the face of the expected effects of climate change.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 4.2. ADAPTIVE PLANNING AND MANAGEMENT OF PROTECTED AREAS

117

DESCRIPTION OF THE LINE OF ACTION

Protected areas are a valuable tool for maintaining ecosystems in a good condition, with high resilience and the capacity to provide environmental services in a context of climate change.

Climate change is a major challenge for these areas, as it causes environmental changes that can substantially modify their starting conditions (zoning, established restrictions in management plans, etc.). Despite all this, few protected areas incorporate climate change into their planning and management in a profound way.

Incorporation of the climate change factor will require a new approach to management that considers, among other issues:¹²³

- Adopting a global, integrative perspective that considers protected areas and the territory in which they are located as a functional unit.
- Managing uncertainty, basing decision-making on the best scientific information, continuously evaluating the results of the actions undertaken.
- Incorporating change as an ever-present process and increasing the adaptive capacity of ecosystems to new environmental conditions and changes in the natural disturbance regime.
- Developing new governance tools for a new context, involving a wider range of actors, improving social support and awareness of the effects of climate change.

The promotion of adaptive planning and management of protected areas can take the form of measures such as:

- Promoting the development of pilot projects to incorporate climate change adaptation criteria into the planning and/or management of protected areas.
- Facilitating the training of staff working in protected area on impacts, risks and adaptation.

¹²³ - Atauri, J.A. y otros (2018). *Las áreas protegidas en el contexto del cambio global: incorporación de la adaptación al cambio climático en la planificación y gestión*. Segunda edición, revisada y ampliada. Ed. Fundación Interuniversitaria Fernando González Bernáldez para los espacios naturales.

- Conducting a prospective review of protected area networks in a context of climate change (mandate of the CCyTE Bill),¹²⁴
- Developing analyses of the foreseen effects of climate change scenarios on the distribution of habitat types of community interest.
- Updating the Natura 2000 network conservation guidelines to better take into account climate change.

In the future, analyses to define the value of these areas and their subsequent protection regime should consider the role that these territories can play in preventing the risks associated with climate change as a relevant criterion.¹²⁵ In the case of marine waters, it is necessary to continue progressing towards the objective pursued at international objective, which MITERD has assumed, to protect 30% of Spanish marine waters. The network of marine areas in Spain should comprise a representative and well-connected sample of marine habitats and species from the different biogeographical regions present in Spanish seas.

Strengthening marine green infrastructure will also contribute to ensuring the functionality, connectivity and resilience of marine ecosystems. Among the actions to be developed in this area in the short term, the following can be highlighted:

- Identification of new areas worthy of protection, taking into account climate change criteria, among others, for their subsequent declaration as marine protected areas.
- Effective management, based on the best available scientific and local knowledge, and in collaboration with the economic sectors and society, of all the areas that make up the network.
- Identification of the elements that will make up the marine green infrastructure, following the criteria established in the State Green Infrastructure Strategy, and the official declaration of these elements.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, autonomous communities.

124 - According to Article 20.3 of the Draft Climate Change and Energy Transition Bill: Assessment of the medium and long-term representativeness of the networks of national protected areas and Natura 2000 sites, in the different possible climate scenarios, so that the competent administrations can take the appropriate measures to ensure that these networks continue to meet the habitat and species conservation objectives for which they were designed within the mentioned time frames.

125 - For example, dune systems and coastal lagoons can play a protective role against sea level rise; wetlands, peri-urban environments and floodplains can reduce the effects of floods and swells; well-preserved headwaters contribute to water filtration and flow maintenance, etc

COMPLIANCE INDICATOR

- The main protected area planning and management instruments, revised or new, incorporate climate change adaptation.
- The surface area of protected marine areas is increased.

ARE REGULATORY INSTRUMENTS REQUIRED?

Yes

FUNDING

Regular budget of the organisations involved and PIMA Adapta.

LINE OF ACTION 4.3. IMPROVING THE ADAPTIVE CAPACITY OF GREEN INFRASTRUCTURE

DESCRIPTION OF THE LINE OF ACTION

In Spain, Law 33/2015, of 21 September, which amends Law 42/2007, of 13 December, on Natural Heritage and Biodiversity, introduces a new chapter specifically referring to the strategic framework for green infrastructure and ecological connectivity and restoration. The aim is to comply with the guidelines established by the European Commission¹²⁶ through the State Strategy for Green Infrastructure and Ecological Connectivity and Restoration, whose objective is to "set the guidelines for the identification and conservation of the elements of the territory that make up the green infrastructure of Spanish terrestrial and marine territory, and so that the territorial and sectoral planning carried out by the public administrations allows and ensures the ecological connectivity and functionality of ecosystems, the mitigation and adaptation to the effects of climate change, the defragmentation of strategic areas for connectivity and the restoration of degraded ecosystems."

The State Strategy for Green Infrastructure and Ecological Connectivity and Restoration is currently pending final approval. The autonomous communities will use it as a base when drawing up their regional strategies, within 3 years of the publication of the State Strategy in the Official State Gazette (BOE, in Spanish) (art. 15.4 of Law 42/2007).

¹²⁶ - The EC Communication "Green Infrastructure: Enhancing Europe's Natural Capital" calls on EU Member States to create a European Green Infrastructure, which would connect sites of high ecological value or high ecosystem service provision and integrate them into spatial planning.

The Central Administration, in developing the lines of action of the strategy, will approve and carry out three-year work programmes, which will include specific actions to – among other purposes – reduce the effects of ecosystem fragmentation and the loss of ecological connectivity and improve the resilience of Green Infrastructure, favouring mitigation and adaptation to climate change.

As part of its multifunctional nature, Green Infrastructure highlights the important relationship between connectivity and the configuration of the landscape and how this affects the movement and dispersal of species.

Therefore, this line of action will include:

- Interventions aimed at maintaining or improving the provision of ecosystem services, mainly regulating ones.
- Interventions aimed at improving the ecological permeability of the territory and ecological connectivity.
- Interventions aimed at reducing pressures on national systems (changes in agricultural practices, livestock management, forestry management, game and fish management, etc.).
- Interventions aimed at the ecological restoration of ecosystems.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, autonomous communities.

COMPLIANCE INDICATOR

Initiatives are being taken to improve the adaptive capacity of Green Infrastructure.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved and European funds.

LINE OF ACTION 4.4. CONTROL OF INVASIVE SPECIES

121

DESCRIPTION OF THE LINE OF ACTION

Cumulative records of invasive alien species have increased by 40% since 1980, driven by increased trade and human population dynamics and trends. Nearly one fifth of the Earth's land surface is at risk from invasions of fauna and flora, with consequent impacts on native species, ecosystem function and nature's contributions to people, as well as on economies and human health.

The ecological consequences of invasive alien species include impacts on individuals (competition, predation), genetics (hybridisation), population dynamics (extinction), communities (reduced biodiversity) and ecosystems (changes in the physical environment), which have a very negative effect on interactions with climate change (and vice versa). Apart from these ecological consequences, there are also economic implications, since these species have a significant impact on agricultural, livestock and forestry production, and even on public health.

This line of action seeks to promote, through modelling according to climate projections: (1) the identification and prioritisation of the invasive alien species most likely to cause impacts; and (2) the integration of appropriate measures into available instruments to prevent further invasions of those species identified as most prone to be favoured by climate change. These instruments include the following: national strategies for the management, control and possible eradication of invasive alien species,¹²⁷ as well as strategies and plans adopted by regional administrations; the Spanish Catalogue of Invasive Alien Species;¹²⁸ and the List of Alien Species.¹²⁹

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, autonomous communities.

127 - Created through article 64.7 of Law 42/2007, of 13 December, on Natural Heritage and Biodiversity, content developed through article 16 of Royal Decree 630/2013, of 2 August, which regulates the Spanish Catalogue of Invasive Alien Species.

128 - Developed through Royal Decree 630/2013, of 2 August.

129 - Created through article 54.3 of Law 42/2007, of 13 December, on Natural Heritage and Biodiversity. The importation or introduction of the species contained in this list is subject to risk analysis to verify whether they are likely to compete with native species, alter their genetic purity or ecological balances.

COMPLIANCE INDICATOR

- Initiatives related to climate change adaptation are carried out, including the identification of the non-native species with the greatest potential to become invasive in a climate change context, and the inclusion of these species into planning, preventive or corrective instruments, such as the aforementioned catalogues and lists.
- If already present in the Spanish territory, management, control and possible eradication measures are applied to these species.

ARE REGULATORY INSTRUMENTS REQUIRED?

No (although it is possible that the legally established tools – catalogues – may be modified).

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 4.5. INCORPORATING CLIMATE CHANGE INTO THE CONSERVATION OF NATURAL AND SEMI-NATURAL HABITAT TYPES AND THEIR ADAPTIVE MANAGEMENT**DESCRIPTION OF THE LINE OF ACTION**

The Habitats Directive establishes that measures taken under it shall aim to maintain or restore habitat types of community interest to a favourable conservation status. Law 42/2007, of 13 December 2007, on Natural Heritage and Biodiversity, in line with the provisions of the Directive, establishes that the Special Areas of Conservation of the Natura 2000 network must make a significant contribution to maintaining or, where appropriate, restoring the favourable conservation status of these types of habitats.

In addition, Law 42/2007 creates the Spanish Catalogue of Habitats in Danger of Disappearing, which will include those types of habitats whose conservation or, where appropriate, restoration requires specific protection and conservation measures because they are in an unfavourable situation in terms of their occupied surface area or their structure and functioning, among other generic circumstances. For these catalogued habitat types, Law 42/2007 establishes that conservation and restoration strategies will be approved, and they will constitute the guiding framework for the corresponding management plans or instruments.

The incorporation of the 'climate change' factor into the conservation and adaptive management of habitat types can take the form of actions such as:

- Identification, restoration and protection of areas of particular importance for mitigating the impacts of climate change.
- Assessment of the vulnerability of habitat types to climate change at state level. This includes the assessment of the climate impact on habitat types (degree of exposure and sensitivity to the climate event) and the assessment of the adaptive capacity of habitat types to climate change.
- Assessment of the conservation status of habitat types at local level considering climate change.
- Measures to adapt habitat types to climate change. Adaptive management measures include measures to lower non-climate pressures impacting habitat types, improve the resilience of habitat types, maintain the abiotic conditions required by habitat types, reduce the impact of extreme weather events, and identify climate refugia.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, autonomous communities.

COMPLIANCE INDICATOR

- Actions to conserve (and restore, where appropriate, within the framework of Line of Action 4.4.) habitat types include the implementation of measures to improve their conservation in the face of the expected effects of climate change.
- Actions on habitats of community interest must be made explicit in the management plans or instruments for the corresponding Natura 2000 areas.
- Strategies and plans for the conservation and restoration of habitat types included in the Spanish Catalogue of Habitats in Danger of Disappearing shall incorporate appropriate measures for their conservation in the face of the expected effects of climate change.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved and European funds.

1.5. FORESTRY, DESERTIFICATION, HUNTING AND INLAND FISHERIES

In Spain, mountains cover an area of 27.8 Mha, of which 18.4 Mha are tree-covered and 9.4 Mha are treeless.¹³⁰ The geographical situation and a complex orography determine a great diversity of forest ecosystems. The effects of climate change on these ecosystems are already evident in many respects: changes in the distribution of arboreal and supra-arboreal forest formations, structural and functional modifications, alterations in certain forest health parameters, greater vulnerability to extreme weather events and wildfires, changes in the flow of environmental goods and services provided by forests, etc. The projected impacts, according to future climate scenarios, point to a progressive intensification of these effects as the 21st century moves on. Forestry activities are also subject to risks and uncertainties arising from climate change of different types: abiotic (environmental and biophysical), biotic (pests and diseases) and economic.

Desertification, for its part, both impacts and is affected by climate change. According to the Convention to Combat Desertification, countries with arid and semi-arid areas, or areas prone to flooding, drought and desertification, are particularly vulnerable to the adverse effects of climate change. Therefore, in a country like ours, which is subject to pronounced water irregularity and with a strong tendency towards aridity in large parts of the territory, the consequences of climate change will be particularly severe. In turn, the phenomenon of desertification contributes to exacerbating climate change. It is therefore essential to coordinate activities in the field of desertification with research efforts and adaptation strategies.

Hunting is one of the main traditional uses of rural areas in Spain. More than 87% of the Spanish territory is subject to some kind of hunting management, equivalent to 43.8 Mha, distributed over more than 31,700 hunting reserves. Although there are not yet a large number of studies on the subject, it is expected that climate change will affect hunting activity due to the direct impacts on the ecosystems inhabited by game species, and consequently, on the biology and distribution of the species themselves, which may have repercussions both on hunting seasons and spatial distribution, as well as on interactions with other uses of the environment in general.

As for inland fishing, this activity is carried out in more than 3,700 watercourses and bodies of water, totalling more than 47,000 km of rivers and reservoirs. Inland fishing has conditioned the distribution and presence of ichthyofauna in Spanish river ecosystems, especially through the introduction of exotic species, some of which are subject to sport fishing in the places and under the conditions permitted by natural heritage and biodiversity legislation.

¹³⁰ - Based on the international definitions of the UN Forest Resource Assessment and [Forest Europe](#).

The acclimatisation of these exotic species is among the main threat factors that negatively affect the survival of native river fish species (of the 59 freshwater species present in Spain, 52 are in one of the IUCN threat categories) and the ecosystems that support them. The effects of climate change on river ecosystems (which may involve altering the distribution and abundance of populations), amplified by the problems of pollution and the expansion of exotic species, could condition the practice of inland fish farming in the future.

In addition, other activities such as pastoralism must be taken into account in the climate change adaptation of the forestry sector, which also includes a large portion of grazing resources. Pastoral uses of land are strengthened through livestock trails, which favour the national extensive livestock population and have an impact on the use of pastures and the preservation of local breeds, providing great wealth and variability in the future adaptation of livestock farming to adverse climatic conditions.

LINE OF ACTION 5.1: INTEGRATION OF CLIMATE CHANGE INTO PLANNING INSTRUMENTS WITH IMPLICATIONS FOR THE MAINTENANCE AND IMPROVEMENT OF FOREST RESOURCES

DESCRIPTION OF THE LINE OF ACTION

The planning instruments for forests and the Spanish forestry sector, such as the Spanish Forestry Strategy, the Spanish Forestry Plan, the Forest Resource Management Plans and the Spanish Strategy for the Conservation and Sustainable Use of Forest Resources, among others, coordinate and guarantee the coherence of forest-related policies and allow synergies with other sectors that influence forest management. They also create the conditions for the multifunctional potential of Spanish forests to be managed in a sustainable and balanced way, allowing forests to provide a set of vital services.

It is important that revisions of these instruments and the development of new general planning documents for forest resources respond to the challenges and threats posed by climate change, which may exacerbate the effects of storms and wildfires or biotic damage. In turn, climate considerations should be incorporated into relevant instruments in order to adapt harvest planning to climate change scenarios in terms of resource efficiency, raw materials, logistics, structural adaptation, innovation, education, capacity building and skills, information and communication.

Due to its influence on the forestry sector, it is also of vital importance that the future Spain's Strategic Plan for the Common Agricultural Policy 2021-2027

considers adaptation to climate change, so that the measures programmed enable the forestry sector to address the potential impacts of climate change, as well as contributing to increasing the resilience of the sector.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, MAPA, autonomous communities.

COMPLIANCE INDICATOR

- The main revised or new forest planning instruments incorporate climate change adaptation.

ARE REGULATORY INSTRUMENTS REQUIRED?

Yes

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 5.2: REVISION AND UPDATING OF FOREST MANAGEMENT GUIDELINES AND STANDARDS

DESCRIPTION OF THE LINE OF ACTION

For several decades, the forestry administration has been promoting the development of forestry planning and management in different spheres, which has led to the need to organise the management of forests and their use, mainly through forest management projects, forest management plans and technical plans. These instruments, among others, are the tools that enable forest planning and management for each specific forest according to its ecological, social and economic characteristics, while facilitating the incorporation of new management guidelines derived from advances in the knowledge of forest systems.

At present, there are various instruments, planned or in force, governing the planning and management of forests at different levels, such as the common basic guidelines for sustainable forest management (Central Administration), forest management instructions (autonomous communities) and standard forest management models (autonomous communities).

It is essential that these documents integrate climate considerations to help incorporate climate change adaptation into the day-to-day management of every forest. Forest management promotes the conservation of forest ecosystems,

improves their environmental, socio-cultural and economic functions, and can increase the contribution of forests to climate change mitigation, as well as enable forests and forest-dependent populations to adapt to the new conditions brought about by climate change. Of course, forest management is not only about addressing climate change, but has many objectives, often complementary to each other: production of goods, protection of soil, water and other environmental services, conservation of biodiversity, provision of socio-cultural services, livelihood support and poverty reduction. Therefore, efforts to adapt to the effects of climate change must create synergies and be in harmony with other national and local forestry objectives.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, autonomous communities.

COMPLIANCE INDICATOR

- The main revised or new forest management guidelines and instruments incorporate climate change adaptation.

ARE REGULATORY INSTRUMENTS REQUIRED?

Yes

FUNDING

Regular Budget of the organisations involved.

LINE OF ACTION 5.3: PROMOTING THE INTEGRATION OF CLIMATE CHANGE INTO HUNTING AND INLAND FISHING POLICIES AND MEASURES

DESCRIPTION OF THE LINE OF ACTION

The effects of climate change will have important consequences on the hunting and inland fishing sectors, including the spread of new pathogens and invasive alien species, population imbalances and habitat changes that will lead to changes in the areas of distribution of different species, as well as changes in their breeding and migration seasons, where appropriate.

In view of these expected changes in hunting and fishing activity, it is therefore essential, while making progress in knowledge generation, to integrate adaptation into forestry, hunting and inland fishing regulations, as well as into planning and

management instruments, with special mention of the future National Hunting Management Strategy.

The National Hunting Management Strategy proposes, as part of the goal to develop a sustainable hunting model integrated into rural development, specific actions that aim to highlight the contribution of the hunting sector to climate change adaptation. It is necessary to continue in this direction in order to contribute to the conservation and improvement of ecosystems and their balance with other activities, and the uses and services of the natural environment through adaptive hunting management.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, MAPA, autonomous communities.

COMPLIANCE INDICATOR

- The main planning instruments for hunting and inland fisheries incorporate climate change adaptation.

ARE REGULATORY INSTRUMENTS REQUIRED?

Yes

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 5.4: PROMOTING THE PREVENTION OF DESERTIFICATION AND THE RESTORATION OF DEGRADED LAND

DESCRIPTION OF THE LINE OF ACTION

The interactions between desertification and climate change are evident and well documented by the bodies deriving from both the United Nation Convention to Combat Desertification and the United Nation Framework Convention on Climate Change.

As stated in the IPCC report on land and climate change¹³¹, climate change, including the increase in the frequency and intensity of extreme events, is contributing to desertification and land degradation in many regions, including the Mediterranean region. Among the growing risks associated with desertification

131 - <https://www.ipcc.ch/srccl/>

is the exposure and vulnerability of the population to water scarcity in drylands, while the risks related to land degradation include greater habitat deterioration, increased exposure to wildfires and floods, and the costs associated with these events.

Many responses that contribute to climate change adaptation can also combat desertification and land degradation, so it is essential to continue to work in a coordinated manner on both aspects to achieve complementary and synergistic strategies and measures. Addressing desertification and land degradation in a manner consistent with climate policies can also generate numerous potential co-benefits (for example, improved biodiversity or increased food security through climate change mitigation).

The promotion of the prevention of desertification and the adaptive restoration of degraded land can take the form of measures such as:

- Application of nature-based solutions in erosion control.
- Integration of land degradation prevention into various land management policies and regulations.
- Sustainable management of aquifers, development of the culture of water as a limited resource.
- Appropriate silvicultural treatments to improve the quality and biological diversity of protective forest areas, to guarantee their stability and to ensure their resistance and functionality under extreme conditions.
- Management of extensive livestock farming in arid and semi-arid areas, with the evaluation of fodder supply, carrying capacity of pastures and adaptation of stocking rates.
- Rehabilitation of abandoned and severely disturbed areas such as quarries, mining areas, mining waste facilities, landfills, etc.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, autonomous communities.

COMPLIANCE INDICATOR

- Policies to combat desertification are systematically coordinated and coherent with those on climate change adaptation.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved and European funds.

LINE OF ACTION 5.5. INTEGRATION OF CLIMATE PROJECTIONS AND ADAPTATION MEASURES INTO FOREST WILDFIRE PREVENTION POLICIES AND MEASURES

DESCRIPTION OF THE LINE OF ACTION

Climate projections for the Spanish territory coincide in pointing to an increase in extreme weather events, especially in the summer season, both in terms of frequency and duration and their annual distribution. Heat waves or groups of days with extreme temperatures and low relative humidity are directly associated with the occurrence of large forest wildfires, as they generate ideal conditions for fuels to burn and, consequently, greater ease of ignition and spread. It is therefore essential to implement climate change adaptation programmes in the area of forest wildfires.

Due to the incidence and consequences of forest wildfires in our country, many organisations are involved in their prevention and extinction, although the degree of collaboration needs to be expanded.¹³² In this context, coordinating the incorporation of the climate projections and adaptation measures produced by the different bodies responsible for fighting forest wildfires is essential not only in relation to the ecological management of ecosystems, but also in the modification of the social patterns behind the occurrence of most wildfires. It is therefore important to emphasise climate considerations in forest wildfire prevention planning, wildfire suppression and the restoration of burned land.

Ecological knowledge of forest systems allows us to address the expected impacts of climate change and to manage landscapes in order to make them more resistant and resilient to increased wildfire incidence. The integration of sectoral policies and the involvement of responsible actors in forestry – as well as the promotion of agroforestry systems and traditional uses such as pastoralism – within a perspective of expected climate change and wildfire risk, are good mechanisms for implementing adaptive measures in the face of the increased danger of wildfires.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, MIR, autonomous communities

¹³² - Consult the strategic guidelines for wildfire management at https://www.mapa.gob.es/es/desarrollo-rural/temas/politica-forestal/orient_estrategicas_gestion_iiff-2019_tcm30-523469.pdf

COMPLIANCE INDICATOR

- Forest wildfire policies are systematically coordinated and consistent with climate change adaptation policies.

ARE REGULATORY INSTRUMENTS REQUIRED?

Yes

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 5.6. EXPANDING AND UPDATING KNOWLEDGE ON CLIMATE IMPACTS AND RISKS AND ADAPTATION MEASURES IN THE FORESTRY SECTOR, HUNTING AND INLAND FISHERIES, AND COMBATING DESERTIFICATION

DESCRIPTION OF THE LINE OF ACTION

Numerous lines of research still need to be developed in relation to climate change adaptation in the forestry sector. In general terms, they can be brought together in the development of sustainable management models which are adapted to climate change, integrate new social demands with existing traditional forest management, and applied to each type of forest ecosystem present in our geography, taking into account the socio-economic conditioning factors. Similarly, improving knowledge of the edaphic parameters of Spanish soils is a very important line of action to generate the basic information required to support adaptation measures in forestry and pastureland areas.

In terms of genetic resources, there is scientific knowledge, for many relevant forest species, of the genetic variability of different origins and progenies and their relationship to adaptive traits on the basis of established genetic tests. However, most of these trials were set up to assess aspects of interest other than adaptation to climate change. It is therefore necessary to improve knowledge on this issue and to broaden the recommendations for the use of forest reproductive material in this perspective.

The remarkable study and research effort on desertification carried out by our country over the last 20 years has provided results of great diversity and interest. Nonetheless, further progress must be made in this direction, looking deeper into emerging issues such as climate migrations or territorial vulnerability analyses.

For hunting and inland fisheries, it should be assessed whether the management of these activities should be modified to better adapt to climate projections. There is no compilation of existing scientific information on the impact of climate change on hunting and inland fisheries (shifting seasons and species closures, changes in breeding periods, etc.), and their possible synergies with, on the one hand, the spread of invasive alien species, and on the other hand, the incidence of pathogens and zoonoses on wildlife and livestock.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, autonomous communities.

COMPLIANCE INDICATOR

- The assessment of climate change impacts and adaptation in forestry, hunting and inland fisheries and the fight against desertification is regularly updated in line with the latest available climate models and scenarios.
- New studies and information are generated in areas relevant to the adaptation of forestry, hunting and inland fisheries and their integration in the fight against desertification.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved and PIMA Adapta.

I.6. AGRICULTURE, LIVESTOCK, FISHERIES AND AQUACULTURE AND FOOD

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One of the basic aspirations of any society is to ensure access to sufficient, safe and nutritious food to meet its needs, which is also one of the main guarantees of human well-being.

Guaranteeing food security in Spain in the face of the risks arising from climate change¹³³ involves ensuring food chains that are well adapted to the projected changes, make sustainable use of natural resources and provide an adequate quality of life for those involved each of the stages. All these issues have a particular impact on rural areas. Furthermore, consumers, as a key element of the food system, need to be informed about the impacts of their dietary choices and be provided with incentives to facilitate positive supply-demand interactions that enhance adaptation and resilience to climate change.

Agriculture, livestock, fisheries and aquaculture are strategic sectors in Spain, with great economic, social, territorial and environmental importance. The food sector is also one of the most important sectors of the Spanish economy and the food industry is the leading industrial sector.

The area used for agricultural and livestock activities in Spain, arable land and land used primarily for pasture, is around 25 million ha,¹³⁴ half of the total area of the country. In agriculture, arable crops occupy most of the area (9 million ha), followed by fallow land and other unoccupied land (3 million ha) and woody crops (4.7 million ha), with olive groves being the woody crop with the largest area. Approximately 78% of the cultivated area is rainfed and 22% is irrigated. In the livestock sector, pigs have the largest number of head (31 million), followed by sheep (16 million), cattle (6 million) and goats (3 million). In terms of the fisheries and aquaculture sector, the marine fisheries sector had a turnover of 1 billion euros in 2018, generating around 30,000 jobs. Aquaculture, for its part, had a turnover of more than 700 million euros in the same year and generated 18,800 jobs.

133 - The draft Climate Change and Energy Transition Law dedicates its article 20 to the “consideration of climate change in food security”, recognising the need for public administrations to promote the improvement of knowledge on the effects of climate change on food security and diet, and to design actions aimed at addressing them. To this end, it is established that the National Climate Change Adaptation Plan should include “specific strategic objectives, associated indicators and adaptation measures aimed at mitigating food security risks associated with climate change, including the appearance of emerging food risks”.

134 - MAPA Statistical Yearbook 2018 <https://www.mapa.gob.es/estadistica/pags/anuario/2018/anuario/AE18.pdf>

These sectors are highly vulnerable to the effects of climate change, with impacts that are already evident¹³⁵ and which, in the absence of adaptation measures, will only increase as the 21st century progresses. Impacts on the agricultural sector include, among others, crop damage, losses and disturbances due to increased extreme weather events; reduced yields of rain-fed crops; changes in pest and disease patterns; northward displacement of areas suitable for certain crops; increased area suitable for some agricultural species due to the disappearance of frost; and increased photosynthetic rates of some crops due to increased atmospheric CO₂ concentration. In the case of the livestock sector, these include the impact on livestock due to heat stress; reduced livestock production due to animal distress and diet imbalance; reduced pasture availability; and changes in pest and disease patterns. The main impacts on fisheries are related to the geographical redistribution of marine species as a consequence of warming, acidification and loss of oxygen from seawater, as well as variations in catch yields. Finally, in the case of marine aquaculture, the impacts come from the increased violence of storms and changes in bioclimatic production conditions, while inland aquaculture will be impacted by lower rainfall and river flows.

Both the agricultural and fisheries sectors are, for the most part, regulated by the Common Agricultural Policy (CAP) and the Common Fisheries Policy (CFP). Successive reforms of both policies have strengthened environmental protection and climate action issues, including them as priority objectives and gearing them towards achieving the EU climate and environmental goals.

LINE OF ACTION 6.1. EXPANDING AND UPDATING KNOWLEDGE ON IMPACTS, RISKS AND ADAPTATION FOR THE MAIN CROPS, LIVESTOCK SPECIES, FISHERIES AND AQUACULTURE IN SPAIN, AS WELL AS IN THE FOOD SECTOR, INCLUDING THE INTERRELATION OF ALL ELEMENTS OF THE FOOD SYSTEM

DESCRIPTION OF THE LINE OF ACTION

The food sector in Spain is of great economic, social, territorial and environmental importance, and brings together a great diversity of crops, livestock species, fisheries, aquaculture production and production systems. The various studies carried out in recent years to assess the impacts and risks of climate change in

¹³⁵ - Report "Impactos, vulnerabilidad y adaptación al cambio climático en el sector agrario: Aproximación al conocimiento y prácticas de gestión en España", MAGRAMA 2016

the sector, and to identify the main adaptation options, show that it is important to assess each agricultural, livestock, fishery or aquaculture activity according to the climatic and environmental conditions in which it is carried out and the practices adopted.

Moreover, it is considered relevant to assess the vulnerability of the food system as a whole, taking into account the interrelationships of all the elements that make it up so that, as recommended by the latest IPCC report on "Climate Change and Land" published in 2019, the system is addressed from a holistic approach, including aspects ranging from production, processing and marketing to food consumption (diet) and food waste.

This line of action is aimed at expanding and updating knowledge on climate impacts and risks and adaptation measures for the main crops, livestock production, fisheries and aquaculture production and the food system in Spain, taking into account regional climate projections based on the models and scenarios used in successive IPCC reports.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, MITERD, MAPA, AEMET, with the collaboration of research institutions and centres, autonomous communities and organisations involved in food production, processing and marketing.

COMPLIANCE INDICATOR

- Up-to-date assessments of the impacts and risks of climate change based on the latest climate models and scenarios are available.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved, PIMA Adapta and other programmes or initiatives.

LINE OF ACTION 6.2. STRENGTHENING ADAPTATION TO CLIMATE CHANGE IN THE POST-2020 COMMON AGRICULTURAL POLICY IN SPAIN**DESCRIPTION OF THE LINE OF ACTION**

The Common Agricultural Policy (CAP) for the post-2020 period will play a key role in guiding agricultural production and practices in Spain. The Regulation proposals presented by the European Commission in 2018 underline the need for this post-2020 CAP to better respond to current and future challenges, with a particular focus on the environment and climate change.

This future CAP sets out nine specific objectives, based on the three pillars of sustainability (objective 4 refers to "contributing to climate change mitigation and adaptation, as well as sustainable energy"), complemented by a common cross-cutting objective of modernising the agricultural sector through knowledge, innovation and digitalisation in rural areas, which is also key to tackling climate change.

MAPA is currently preparing Spain's Strategic Plan for the post-2020 CAP, in collaboration with MITERD, the autonomous communities, and agricultural and environmental organisations. This Strategic Plan, which must respond to the future needs of agriculture in our country, is being drawn up on the basis of the European Commission's legislative proposals, which provide for greater environmental ambition and climate action, and must involve the effective participation of the competent authorities for the environment and climate (as stated in Art. 94.2. of the proposed Regulation which establishes the guidelines for the strategic plans to be drawn up by the Member States).

This line of action aims to strengthen the climate change adaptive component of future CAP interventions in order to meet the above-mentioned objectives and to achieve an agricultural sector that can cope with the impacts of climate change and, at the same time, contributes to the increased resilience of the sector.

RESPONSIBLE ENTITIES AND COLLABORATORS

MAPA and autonomous communities, MITERD.

COMPLIANCE INDICATOR

- Spain's Strategic Plan for the post-2020 CAP includes provisions that promote climate change adaptation in the agricultural sector.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

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FUNDING

Funds equivalent to EAFRD and EAGF (post-2020 CAP) and regular budget of each organisation.

LINE OF ACTION 6.3. REVIEW OF EXISTING AND FUTURE PLANS, REGULATIONS AND STRATEGIES RELATED TO THE AGRICULTURE, LIVESTOCK, FISHERIES AND AQUACULTURE SECTORS, TAKING INTO ACCOUNT NEW CLIMATE SCENARIOS

DESCRIPTION OF THE LINE OF ACTION

The different plans, regulations and strategies affecting the agriculture, livestock, fisheries, aquaculture and food sectors should be reviewed and updated to integrate the climate change variable, considering, where appropriate, its main effects (increase in temperature, variation in rainfall patterns, increase in the intensity and frequency of extreme events, increase in acidification of the sea, etc.), taking into account regionalised climate projections for Spain based on the models and scenarios used in the IPCC reports.

This integration of climate change should also be considered in the new plans, regulations and strategies developed for the Spanish agricultural sector (arable and industrial crops, fruit and vegetables, wine and olive production), and for the livestock, fisheries and aquaculture sectors.

Furthermore, taking into account the impacts of climate change on the availability and quality of water resources in Spain, it will be necessary to consider these impacts in irrigation planning and, therefore, in the coordination of agricultural policy and hydrological planning.

RESPONSIBLE ENTITIES AND COLLABORATORS

MAPA and autonomous communities, MITERD.

COMPLIANCE INDICATOR

- The most relevant plans, regulations and strategies incorporate climate change.

ARE REGULATORY INSTRUMENTS REQUIRED?

To be assessed.

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 6.4. FOSTERING PRACTICES THAT PROMOTE GREATER RESILIENCE TO THE IMPACTS OF CLIMATE CHANGE ON THE FOOD SYSTEM**DESCRIPTION OF THE LINE OF ACTION**

Soil and water management and biodiversity conservation are essential pillars for the adaptation of the Spanish agricultural and livestock sector to climate change. The PNACC should promote best agricultural practices to ensure that, through the proper management and conservation of these resources, the sector becomes more resilient to the impacts of climate change. In many cases, this will also have strong synergies with mitigation, by increasing the sector's CO₂ fixation capacity.

Among the practices that promote greater resilience to the impacts of climate change, the most recent studies highlight organic farming, conservation agriculture, extensive livestock systems and precision agriculture, among others.¹³⁶

However, the agricultural sector not only suffers the consequences of the impacts of climate change, but its own practice can sometimes be a cause of increased vulnerability to these impacts. There are practices and measures that can minimise this vulnerability, including hydrological-forestry restoration in areas at high risk of erosion; the promotion of native forest crops to replace agricultural crops in flood-prone areas; crop rotation and diversification; the maintenance of vegetation covers and the incorporation of pruning remains into the soil in woody crops; saving and efficiency measures aimed at reducing net water consumption; and a commitment to crop varieties or livestock species that are better adapted to the impacts of climate change.

136 - For more than 20 years, MAPA has maintained the Agroclimatic Information System for Irrigation (SiAR), an infrastructure that captures, records and disseminates agroclimatic data that generates valuable open datasets for the agricultural sector. The system provides a series of services with the main objective of achieving a reduction in water consumption, offering data on the water demand of irrigated crops and helping the farmer to make decisions on when and how much to irrigate. The improvement and development of climate services linked to SiAR will allow for better water management and water savings in the field of irrigation.

Some of the aforementioned practices and measures also have the particularity of fixing CO₂ and acting as agricultural sinks, and they have been included in the National Integrated Energy and Climate Plan (2021-2030) together with other measures that promote the reduction of GHG emissions.

It is also worth mentioning that, in order to achieve a more adapted food system, it is necessary to promote the bioeconomy and the circular economy across all stages, which will generate important benefits for rural populations. It will also be important to promote short trade channels and local agriculture to address the vulnerability that climate change is expected to produce in the food trade on a global scale.

RESPONSIBLE ENTITIES AND COLLABORATORS

MAPA and autonomous communities, with the collaboration of MITERD.

COMPLIANCE INDICATOR

- Instruments are in place to support more resilient crop and livestock farming practices.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 6.5. DEVELOPMENT OF COMMUNICATION ACTIONS ON THE RELATIONSHIP BETWEEN FOOD AND CLIMATE CHANGE FOR A MORE RESPONSIBLE FOOD CONSUMPTION

DESCRIPTION OF THE LINE OF ACTION

The food choices made by Spaniards contribute to the orientation of the food system as a whole and can play a positive role in the consolidation of sustainable and resilient production models and practices. In this sense, it is important that consumers, when making their purchasing choices, are aware that different food products, including water, and their production systems, as well as distribution and logistics chains, have different impacts on the environment and on the fight against climate change.

Furthermore, it is estimated that one third of the food produced is currently wasted, a fact that is totally incompatible with the need to feed a growing population in an agricultural environment where many of the productions are going to see their productivity reduced by the impacts of climate change.

For all these reasons, and in view of the foreseeable changes that will take place in largely globalised food systems, it is crucial to inform, raise awareness and educate consumers about the different food options, the real cost of food production, including environmental costs, and alternative and more sustainable systems of production, distribution and consumption.

This line of action requires the collaboration of actors involved in the production, processing and distribution of food, including external trade, as well as competent bodies in food consumption and those responsible for food health policies.

This line is closely related to line 17.5, which is generally oriented towards the promotion of resilient and climate-adapted lifestyles.

RESPONSIBLE ENTITIES AND COLLABORATORS

MAPA, MAPA, MITERD, Ministry of Consumer Affairs, Ministry of Health, AESAN (Spanish Agency for Food Safety and Nutrition, Ministry of Consumer Affairs), in collaboration with the autonomous communities and local authorities within the scope of their competences.

COMPLIANCE INDICATOR

- The departments involved in this action promote food habits that contribute to more sustainable and resilient models.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Budget of the organisations involved.

LINE OF ACTION 6.6. STRENGTHENING ADAPTATION TO CLIMATE CHANGE IN THE COMMON FISHERIES POLICY (CFP), IN NATIONAL MANAGEMENT AND RECOVERY PLANS AND IN THE AQUACULTURE SECTOR

DESCRIPTION OF THE LINE OF ACTION

The projected impacts of climate change on the marine environment will consist mainly of an increase in the temperature of the water, an increase in its acidity level, a decrease in the oxygen level and an increase in the violence of storms at sea. These physical and chemical effects will result in changes to species distribution, an increase in invasive species and fish productivity losses.

Faced with this scenario, the Common Fisheries Policy already considers the effects of climate change through scientific assessments of different fish stocks, which are the basis for the adoption of management measures for catches. Its future reform should enhance scientific knowledge in relation to climate change and its effects, contributing to the social and economic sustainability of the coastal communities which are dependent on fisheries.

It is therefore proposed that the effects of climate change continue to be taken into account in the design, implementation and monitoring of the CFP and, in particular, its application in Spain.

Similarly, the national fisheries policy will integrate climate change considerations in the design, implementation and monitoring of management and recovery plans, as well as in the aquaculture sector.

RESPONSIBLE ENTITIES AND COLLABORATORS

MAPA and MITERD, in collaboration with the autonomous communities within the scope of their competences.

COMPLIANCE INDICATOR

- The Common Fisheries Policy and the national management and recovery plans for fisheries and the aquaculture sector in Spain integrate climate change considerations.

ARE REGULATORY INSTRUMENTS REQUIRED?

Yes

FUNDING

Budget of the organisations involved.

I.7. COASTS AND MARINE ENVIRONMENT

The coastal area is home to a third of Spain's population, although it makes up only 6.7% of the territory. Over the first few years of the 21st century, the resident population in coastal municipalities grew at a higher rate than the national average (1.9%, compared to 1.6% overall). The coasts are also a key attraction for one of the country's main economic activities: tourism.

Climate change-related coastal hazards include the increased frequency and intensity of coastal storms, permanent inundation due to sea level rise, increased erosion and loss of key ecosystems due to seawater warming.

According to projections made under the framework of the C3E project,¹³⁷ updated in 2019, coastal features will experience an increase in flooding, which will be moderate in intensity but more significant in frequency. By way of example, it has been estimated that, in the city of Bilbao, over a period of 50 years, the flood level would rise from 3.85 m in 2010 to 4 m in 2040. However, the flood level of 3.85 m would change from once every 50 years to once every 15 years in 2040.¹³⁸ For non-rigid coastal features, such as beaches, sea level rise results in the loss and fragmentation of habitats and, in many cases, a retreat of the sandy beach, with significant differences between different stretches of coastline.

The Spanish Coastal Climate Change Adaptation Strategy, adopted in 2017, classifies adaptation options into three broad groups:

Protection: The ultimate aim is to protect at-risk areas, whether they are part of the socio-economic or natural system, by attempting to prevent impacts from occurring. Examples include the regeneration of dune systems, the protection of seagrass beds, the protection and restoration of coastal wetlands and marshes, and the re-establishment of artificially interrupted sediment transport. In the marine context, an effective adaptation strategy is the establishment and management of a coherent, connected and representative network of marine protected areas that promotes resilience to climate change.

Accommodation: Elements at potential risk are retained in the affected areas, with priority given to reducing vulnerability through a variety of actions: measures that increase readiness for potential impacts (early warning systems,

137 - <https://c3e.ihcantabria.com/>

138 - Losada, I. y otros (2014). *Cambio climático en la costa española*. Magrama, Madrid.

evacuation protocols, etc.), introduction of specific regulations for the construction of infrastructures and buildings (elevation of dwellings, changes in the design of foundations, protection against humidity, etc.).

Retreat: These are based on the planned abandonment of areas likely to be affected by the impacts of climate change or extreme hazards. Examples are the relocation of highly exposed housing and infrastructure to safe areas and the public acquisition of land on the coastline in order to incorporate it into the Maritime-Terrestrial Public Domain.

In addition, the Strategy also uses the classification proposed in the IPCC's Fifth Assessment Report, which organises adaptation options into the following categories:

1. Structural and physical: engineering, technology, ecosystem-based, services.
2. Social: education, information, behaviour.
3. Institutional: economics, laws and regulations, government policies and programmes.

LINE OF ACTION 7.1. DEVELOPMENT OF RISK ANALYSIS TOOLS AND THE DEFINITION OF ADAPTATION INITIATIVES ON THE COAST AND AT SEA

DESCRIPTION OF THE LINE OF ACTION

This line of action is aimed at providing the different public and private sectors with competence and strategic interests in the coastal space with useful methods and tools to manage the risks arising from climate change. In this regard, the Directorate General for the Coast and the Sea is working on the identification of flood-prone areas as a result of the effects of climate change.

Among the specific actions to be developed in this line of work, the following can be highlighted:

- Regular updating of climate change projections for the Spanish coast and of the C3E scenario viewer, using the latest climate models compiled by the IPCC.
- The definition of methodological proposals applicable to territorial and urban planning in coastal areas. As an example, MITERD could define standards to facilitate the delimiting of areas at risk of being reached by the sea due to storms or extreme weather phenomena.
- Elaboration of methodological guidelines aimed at limiting the damage caused by coastal storms in urban areas or areas of public interest, for

- example, by reducing the level of risk to buildings and infrastructure.
- Support the autonomous communities in the preparation of risk reports and adaptation plans in the areas and infrastructures under their jurisdiction.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD and the autonomous communities involved, with the collaboration of DGPCE (MIR), local entities.

COMPLIANCE INDICATOR

- Climate change projections for the coast are updated on a regular basis.
- Methodological guides are developed to limit the damage caused by coastal storms in urban areas or other areas of public interest.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved and European funds.

LINE OF ACTION 7.2. CHANGES TO REGULATORY FRAMEWORK TO FACILITATE COASTAL AND MARINE ADAPTATION

DESCRIPTION OF THE LINE OF ACTION

This line of action is aimed at studying and proposing changes to the regulatory framework in order to improve the effectiveness of responses to coastal hazards. Challenges in this field include the following:

- Incorporation of objective criteria for the granting of occupancy titles for the Maritime-Terrestrial Public Domain, or its extensions, based on the best available science.
- Increasing flexibility in the granting of occupancy titles, for example, by being able to limit or reduce the terms of concessions or speed up their review due to climate change.
- Streamlining the revision of the boundaries of the Maritime-Terrestrial Public Domain, based on scientific data.
- Identification of other barriers to adaptation within the regulatory framework.

Among the regulations that could be subject to revision to facilitate adaptation processes are the Coastal Law and Regulation and the Law on Land and Urban Rehabilitation.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD and autonomous communities with competences in this area.

COMPLIANCE INDICATOR

- Working groups are set up to analyse and, if necessary, propose possible changes to the regulatory framework.
- Proposals for legal changes to facilitate adaptation in the coastal and marine environment are approved, where appropriate.

ARE REGULATORY INSTRUMENTS REQUIRED?

Yes

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 7.3. INTEGRATION OF COASTAL RISKS INTO PLANS AND PROGRAMMES THAT INCLUDE THE COASTAL SPACE

DESCRIPTION OF THE LINE OF ACTION

This line of action is oriented towards the production of climate change adaptation plans for key elements of the coastline, highlighting adaptation plans for state-owned ports and adaptation plans in areas of the Maritime-Terrestrial Public Domain (DPMT, in Spanish) assigned to the autonomous communities or ports transferred to them.

It also includes the development of actions to facilitate the consideration of risks arising from sea level rise and the increased risks associated with maritime storms in already established plans, such as Spatial Plans affecting coastal territories and General Urban Plans.

Maritime spatial plans should also incorporate the climate change component into the planning of present and future human activities in the marine environment.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, OPPE and port authorities, autonomous communities and coastal municipalities with the collaboration of the DGPCE (MIR).

COMPLIANCE INDICATOR

- State-owned ports have specific adaptation plans.
- Autonomous communities have adaptation plans for the ports that have been transferred to them or Maritime-Terrestrial Public Domain land assigned to them.
- All General Urban Development Plans from 2021 onwards take into account the risks arising from sea level rise and the effects of maritime storms.
- Maritime spatial plans incorporate the climate change variable.

ARE REGULATORY INSTRUMENTS REQUIRED?

Amendments to coastal legislation regarding flood zones and areas in severe regression may be required.

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 7.4. DEVELOPMENT OF ADAPTATION INITIATIVES IN THE MARITIME-TERRESTRIAL PUBLIC DOMAIN AND RELATED AREAS**DESCRIPTION OF THE LINE OF ACTION**

This line of action is specifically oriented towards the identification, planning and development of adaptation projects and initiatives in the maritime-terrestrial public domain and related areas.

Interventions may include, among others:

- Environmental restoration of natural coastal areas, such as beaches, dune systems and marshes.
- Demolition of artificial features that are deteriorated, highly vulnerable or detrimental to the integrity of the public domain and reduce its adaptive capacity.
- Interventions on at-risk infrastructure to increase its resilience to climate change.

- Relocation of at-risk infrastructure and buildings or changes in land use in approved but not implemented Urban Plans to avoid the construction of facilities or housing in unsuitable areas.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, other departments of the Central Administration in charge of vulnerable infrastructures, autonomous communities and local entities.

COMPLIANCE INDICATOR

After identifying the best solutions for the risks, the following projects, among others, are developed and implemented:

1. Adaptation projects based on the use of green infrastructure.
2. Projects aimed at increasing the resilience of coastal spaces by removing at-risk artificial elements.
3. Projects to increase the resilience of coastal infrastructure to climate change.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved, PIMAAdapta and European funds.

LINE OF ACTION 7.5. FOSTERING INSTITUTIONAL COORDINATION AND SOCIAL PARTICIPATION FOR ADAPTATION ON THE COAST AND AT SEA

DESCRIPTION OF THE LINE OF ACTION

This line of action is oriented towards the generation of governance and collaboration instruments that facilitate the coordinated action of public institutions and society as a whole for adaptation on the coast and at sea. Among the actions to be developed in this area in the short term, the following can be highlighted:

- Support for outreach and citizen science initiatives focused on monitoring the effects of climate change on coastal and marine areas.
- Strengthening of the technical working group on coastal risks within the Impacts and Adaptation Working Group (GTIA).
- Strengthening of the technical working group on adaptation in ports and other coastal infrastructure.

- Removing barriers to adaptation in the implementation of adaptation strategies.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, with the collaboration of DGPCE (MIR), OPPE, port authorities and autonomous communities.

COMPLIANCE INDICATOR

- Outreach and citizen science initiatives are put in place.
- Technical working groups are strengthened, with a balanced presence of women and men.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

I.8. CITY, URBAN PLANNING AND BUILDING

80% of the Spanish population is concentrated in urban areas, which account for only 20% of the territory, placing us among the countries with the highest percentage of urban population in the whole of the European Union. The impacts of climate change significantly affect the urban environment, the quality of life in cities and the provision of essential services such as transport, water, energy, housing, health and social services.

Proposals for the occupation and distribution of different uses and activities in the urban territory (housing, social facilities, economic activities, services, infrastructure, etc.) must take into consideration the current and future characteristics of the climate and the effects of climate change, so that the urban structure and metabolism are fully adapted to the changing climate conditions. The long lifespan of buildings and infrastructure means that the urban environment faces significant climate risks (damage to materials and structures, higher maintenance costs, loss of value of real estate assets, etc.).

Urban metabolism, understood as the energy flows and the cycles of matter that circulate and feed cities and the territories where they are located, is specifically affected by the effects of climate change, which has impacts on multiple areas, services and sectors. Planning and management by public administrations must therefore provide solutions that minimise risks by acting on exposure and vulnerability.

Many climate impacts are accentuated in built-up areas where unique microclimates can be created in terms of temperature, wind and precipitation. In addition, cities concentrate population, infrastructure and socio-economic activities that are sensitive to climate risks.

Heat waves and their impacts on cities are increased by the "urban heat island" effect, and the intensity of this phenomenon depends on several characteristics such as the spatial form of the city, its morphology, the presence of vegetation or the albedo of the materials used for urbanised surfaces.

Flooding is also favoured by large impermeable urban surfaces, which prevent infiltration and encourage run-off. Moreover, the location of a substantial part of urban areas on the coastline makes them particularly exposed to the effects of sea level rise and extreme coastal events.

The presence of green spaces, the creation of flood zones, the restoration of urban sections of rivers, permeable pavements and sustainable urban drainage systems increase natural drainage and reduce the risk of severe flooding in cities.

Urban planning that promotes green infrastructure and nature-based solutions increases the resilience of cities and achieves numerous co-benefits, such as improved air quality and biodiversity, and better health and quality of life for citizens.

LINE OF ACTION 8.1. LINKING AND REINFORCING THE SPANISH URBAN AGENDA AND THE NATIONAL CLIMATE CHANGE ADAPTATION PLAN AS GOVERNANCE FRAMEWORKS

DESCRIPTION OF THE LINE OF ACTION

One of the targets included in Sustainable Development Goal 11, "Sustainable Cities and Communities" is the adoption and implementation of integrated policies and plans to promote inclusiveness, resource efficiency, climate change mitigation and adaptation, and disaster resilience, by conducting integrated disaster risk management, in line with the Sendai Framework 2015-2030.

The Spanish Urban Agenda (AUE, in Spanish),¹³⁹ published in 2019, presents among its strategic objectives the prevention and reduction of climate change impacts and the improvement of resilience in the urban environment. These objectives are developed through proposals for action that are closely linked to this National Climate Change Adaptation Plan (PNACC).

In addition, this PNACC line of action proposes to advance in a framework of common indicators and objective reference parameters for the monitoring of Urban Agendas and climate change adaptation policies. The AUE emphasises monitoring and evaluation and sets out a dynamic system of indicators which must be shared with the PNACC. There are two different types of indicators: purely descriptive indicators, which should help the territorial administrations with the elaboration of their own diagnoses of the situation and which will be supplied by the Central Administration, and evaluation and monitoring indicators, which are relevant for measuring the degree of effective implementation of the Agenda.

This line of action must be shared with the autonomous communities and municipal authorities, through interdepartmental and intersectoral commissions, in order to tackle adaptation in the urban environment and promote inter-administrative coordination at city level.

139 - <http://www.aue.gob.es/>

RESPONSIBLE ENTITIES AND COLLABORATORS

Directorate General for Housing and Land and DG Urban Agenda and Architecture (MITMA. Ministry of Transport, Mobility and the Urban Agenda, in Spanish), Sectoral Conference on Housing, Urban Planning and Land, OECC and FEMP (Spanish Federation of Municipalities and Provinces, in Spanish).

COMPLIANCE INDICATOR

- The number of cities developing urban agendas increases, including climate change adaptation plans and measures.
- The prospective system of PNACC indicators incorporates indicators from the Spanish Urban Agenda.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 8.2. INTEGRATING CLIMATE CHANGE ADAPTATION INTO TERRITORIAL AND URBAN PLANNING

DESCRIPTION OF THE LINE OF ACTION

Adaptation of the territorial and urban model to the effects of climate change, with particular progress in prevention, is one of the specific objectives of the Spanish Urban Agenda. The actions proposed by the AUE include developing a sectoral, territorial and urban planning that responds to the prevention of natural risks, and incorporating natural risk maps into planning in order to avoid urban transformation actions that could be affected by floods, torrential rains, rising sea levels, water insufficiency, risk of landslides, etc.

The AUE also provides for the inclusion of climate change scenarios, the implementation of climate change emergency plans and the promotion of prevention and adaptation actions on urbanised land susceptible to natural hazards.

In addition to advancing the integration of climate change risks into spatial and urban planning, it is necessary to incorporate the concept of urban green and blue infrastructures into planning, as multifunctional nature-based solutions, which solve urban problems such as improving biodiversity, managing flood-prone areas,

reducing heat islands, combating climate change and improving air quality. There is also a need to promote the incorporation of urban climate mapping into urban planning and management tools, which can encourage the creation of climate refugia.

The AUE includes a specific objective focused on improving resilience to climate change, which incorporates the consideration of the spatial form of the city, its morphology, the presence of vegetation, the albedo of urban surface materials and the application of bioclimatic criteria in the design of open spaces as lines of action.

Proper planning that takes into account the influence of the regional and local climate, compact development, infilling of urban gaps and spaces, and smart densification can preserve space for agriculture, bioenergy and carbon sinks. Proximity urban planning and the reorganisation of urban mobility, giving priority to public transport and active mobility, make it possible to increase air quality and reduce the heat island effect. Low Emission Zones, traffic calming and the recovery of public space are key elements.

The full integration of adaptation into spatial and urban planning should be supported through the analysis and monitoring of the spread of urbanised land in the territory from a climate change perspective. Instruments such as the Urban Information System (SIU)¹⁴⁰ allow the phenomenon to be analysed on a territorial scale, offering tools for the establishment of clear objectives in urban and territorial planning instruments, with the goal of achieving a more rational use of land.

RESPONSIBLE ENTITIES AND COLLABORATORS

DG Urban Agenda and Architecture (MITMA), Directorate General of Housing and Land (MITMA), Sectoral Conference on Housing, Urban Planning and Land, DG European Funds (MH. Ministry of Finance, in Spanish), DGPCE (MIR) and FEMP.

COMPLIANCE INDICATOR

- There are tools for accessing updated electronic information on urban classification and categorisation, available to public and private operators, as well as complementary information on effective land occupation and use, and natural risk areas.
- New territorial and urban plans analyse the risks of climate change, incorporating measures to minimise them.

¹⁴⁰ - <https://www.mitma.gob.es/portal-del-suelo-y-politicas-urbanas/sistema-de-informacion-urbana/sistema-de-informacion-urbana-siu>

ARE REGULATORY INSTRUMENTS REQUIRED?

Climate Change and Energy Transition Law and the adaptation of autonomous community urban planning regulations.

FUNDING

Regular budget of the organisations involved, Housing Plan, European funds.

LINE OF ACTION 8.3. INTEGRATING CLIMATE CHANGE ADAPTATION INTO THE BUILDING SECTOR

DESCRIPTION OF THE LINE OF ACTION

More than half of the Spanish building stock was constructed prior to the entry into force of the first Spanish regulation (NBE CT 1979) which stipulated minimum energy efficiency requirements. Therefore, the reconversion of the property and construction sector towards the renovation and regeneration of buildings and urban renewal is a fundamental aspect to reduce the vulnerability of buildings, especially housing, to climate change.

Responding to many of society's emerging needs inevitably requires a significant transformation of the entire built heritage. Our buildings and public spaces were designed for different situations, needs and lifestyles from those we have today and without considering future climate conditions.

The AUE emphasises the value of urban renovation, regeneration and renewal, identifying areas that allow for the application of integrated physical-spatial, social, economic and environmental intervention policies. The transformation towards the integral improvement of buildings, and the establishment and maintenance of adequate habitability conditions, requires the use of diverse resources and a wide range of actions, both public and private. Making buildings more resilient requires progress in the deployment of the urban green infrastructure, the recovery of rainwater and greywater from buildings and innovations both in terms of materials (for example, permeable road surfaces, timber constructions) and building solutions (for example, bioclimatic architecture, green facades or roofs, seasonal shading solutions, night cooling strategies).

The urban heat island phenomenon needs to be taken into account in urban planning and design, as well as in the design and construction of buildings. This

will require the study of the influence of the regional and local climate, the development of urban climate maps, which analyse the heat absorption and heat transfer capacity of urban materials, and urban ventilation maps.

RESPONSIBLE ENTITIES AND COLLABORATORS

Inter-ministerial Group for the Strategy for the Promotion of a Sustainable Habitat, Long-term strategy for the renovation of building stock (ERESEE, in Spanish), DG Urban Agenda and Architecture (MITMA), Sectoral Conference on Housing, Urban Planning and Land, DG European Funds (MH), Eduardo Torroja Institute for Construction Science (CSIC).

COMPLIANCE INDICATOR

- The number of dwellings and the surface area of buildings subject to renovation increases in the period 2021-2030. (AUE indicators 2.6.3 and 2.6.2, respectively).

ARE REGULATORY INSTRUMENTS REQUIRED?

Update to the Technical Building Code.¹⁴¹

FUNDING

Housing Plan, PAREER Programme and European Funds, which develop the renovation of building stock in accordance with the objectives of the National Integrated Energy and Climate Plan and the Long-term Strategy for Energy Rehabilitation in the Spanish building sector (ERESEE, in Spanish).

LINE OF ACTION 8.3. INTEGRATING CLIMATE CHANGE ADAPTATION INTO THE BUILDING SECTOR

DESCRIPTION OF THE LINE OF ACTION

Spanish cities correspond to an urban model with very positive values, which should be preserved and promoted. Cities are consistent with the Mediterranean model: compact, dense, complex, of medium size, with a mix of uses, with safe common urban spaces that are at the centre of society life and that encourage social diversity, all of which facilitates development and common well-being. How-

¹⁴¹ - The Technical Code should take into consideration future climate change scenarios and projections both for the design of new buildings and for the renovation of existing buildings, in order to make them more resilient throughout their lifetime.

ever, during the housing boom – 1998 to 2007– urban sprawl prevailed, with strong environmental impacts, social segregation, and economic inefficiency derived from the high cost of energy, construction and maintenance of the huge infrastructures and the provision of public services.

To address these models, it is necessary to promote education and citizen participation as key elements in the care of the urban environment, and to put in place a democratic risk management governance with the involvement of all parties interested in planning and management.

The AUE proposes to develop climate change adaptation plans – and to ensure that they are known to the public – and to use them as a tool to preserve and improve living conditions. It also proposes to use the landscape as an opportunity and value for each town and city, incorporating ecological restoration and transforming green spaces into indigenous models in the collective imagination that allow for the efficient management of resources.

To make cities more resilient, the adoption of action protocols must be based on adequate urban diagnostics, the collaboration of all actors, including civil society, and the assessment of resilience to previous crises or risk situations.

In addition, regulations should be developed to guide how to introduce nature-based solutions and green urban infrastructures into urban policies, funding mechanisms and frameworks, specific standards and indicators, as well as specific awareness-raising campaigns on their benefits, and to locally adapt leisure activities in these spaces.

Finally, the potential of city networks (Spanish Network of Cities for Climate, Spanish Local Sustainability Network, Provincial Networks of Municipalities for Sustainability, Urban Initiatives Network, Covenant of Mayors, local CONAMA, etc.) should be harnessed by promoting actions to combat climate change and sharing experiences and good practices.

RESPONSIBLE ENTITIES AND COLLABORATORS

DG Urban Agenda and Architecture (MITMA), Sectoral Conference on Housing, Urban Planning and Land, DG European Funds (MH), OECC and FEMP

COMPLIANCE INDICATOR

Number of people benefiting from training and awareness-raising activities on the topics included in the Urban Agenda (AUE indicator 10.4.2.).

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

I.9. CULTURAL HERITAGE

Cultural heritage is an asset that must be protected against the new risks arising from climate change, but it is also a resource that can strengthen the adaptive capacity of human communities in the face of climate change.

The Sustainable Development Goals recognise that cultural heritage can inspire choices that promote resilience and sustainability. In order to realise this potential, it is important to recognise how the concept of cultural heritage has broadened from a series of sites and monuments identified as artistic elements to include cultural landscapes and historic cities. Moreover, the concept has been further extended to the intangible dimensions of heritage.¹⁴²

The threats posed by climate change to cultural heritage demand the reinforcement, and in some cases the revision, of the basic tasks involved in heritage conservation: its identification and documentation, its conservation and protection, and its use and management. It is therefore necessary to make progress in identifying the risks posed by climate change to the conservation of cultural heritage and in incorporating the climate change factor into preventive conservation plans.

Cultural heritage, understood as a repository of the experience and knowledge accumulated by humankind over time, is a valuable asset for adaptation. Human societies, through trial and error, have built cultures that are adapted to the climates in which they have developed, shaping strategies and solutions in fields as relevant as agriculture, housing and urban planning. Knowledge of such solutions can inspire new practices, turning cultural heritage into a resource for adaptation.

142 - These intangible dimensions include the entirety of knowledge derived from the development and experience of human practices, representations, expressions, knowledge and skills; and associated objects and spaces that communities recognise as part of their cultural heritage. (ICOMOS Climate Change and Cultural Heritage Working Group. 2019. *The Future of Our Past: Engaging Cultural Heritage in Climate Action*. Paris: ICOMOS).

LINE OF ACTION 9.1. INTEGRATION OF CLIMATE CHANGE RISKS IN THE CONSERVATION OF CULTURAL HERITAGE¹⁴³**DESCRIPTION OF THE LINE OF ACTION**

Climate change poses risks, as well as some opportunities, for the conservation of cultural heritage. Recognising and assessing their nature and extent is a necessary first step for the adequate integration of climate change threats into cultural heritage conservation. This line of action, therefore, has two complementary components:

- a) Identification of the main risks and the elements of Spanish cultural heritage that are most vulnerable to climate change, and the identification of possible adaptation strategies.
- b) Incorporation of the climate change variable into the preventive conservation plans for cultural heritage drawn up by DG Fine Arts (including cultural landscape conservation plans)¹⁴⁴, and the incorporation of climate change observations and projections into cultural heritage conservation plans drawn up by Emergencies and Risk Management.

These actions will require, in parallel, the training of professionals involved in the study and conservation of cultural assets in order to incorporate the climate change dimension into their professional activity.

RESPONSIBLE ENTITIES AND COLLABORATORS

DG Fine Arts (MCD. Ministry of Culture and Sport, in Spanish) and DG Urban Agenda and Architecture (MITMA), in collaboration with the autonomous communities within the scope of their competences.

COMPLIANCE INDICATOR

- The main risks to the conservation of cultural heritage associated with climate change are identified.
- Climate change is integrated into preventive conservation plans for cultural heritage.

143 - Spain has joined the initiative "Addressing climate change impacts on cultural and natural heritage", promoted by the Greek government and presented at the Climate Action Summit held under the auspices of the United Nations in September 2019. This initiative calls on States to "Support the protection of cultural and natural heritage from the impact of climate change by mainstreaming this protection into climate change policies and/or processes (...)".

144 - The National Cultural Landscape Plan defines a cultural landscape as "the result of the interaction over time of people and the natural environment, the expression of which is a territory perceived and valued for its cultural qualities, which is the product of a process, and which supports the identity of a community".

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 9.2. IDENTIFICATION AND TRANSFER OF VERNACULAR KNOWLEDGE USEFUL FOR CLIMATE CHANGE ADAPTATION

DESCRIPTION OF THE LINE OF ACTION

Vernacular and traditional knowledge has clear potential value in the fight against climate change. The Paris Agreement recognises that adaptation should, where appropriate, build on and be inspired by traditional knowledge and local knowledge systems.

Spain has an extensive heritage of vernacular knowledge that is closely adapted to the climate conditions that characterise each of our geographical regions.

In the current context of climate change, this knowledge could be put to good use to provide inspiring solutions for territories that will need new solutions in the face of a new climate. Recognising and enhancing the value of this heritage is the basic objective of this line of action. Actions required to move progress in this regard should include:

- Identifying good practices in the use of technologies and vernacular knowledge for adjusting to climate conditions.
- Developing a catalogue of useful traditional technologies and practices for adaptation.
- Organising training activities on the use of traditional technologies and practices for adaptation.

RESPONSIBLE ENTITIES AND COLLABORATORS

DG Fine Arts (MCD) and DG Urban Agenda and Architecture (MITMA)

COMPLIANCE INDICATOR

- A catalogue of useful traditional technologies and practices for adaptation is published.
- Training activities are developed to enable the use of vernacular knowledge in adaptation.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved and PIMA Adapta.

LINE OF ACTION 9.3. PROMOTING RESPONSIBLE, CLIMATE CHANGE-ADAPTED AND LOW-CARBON CULTURAL TOURISM**DESCRIPTION OF THE LINE OF ACTION**

Cultural tourism is the segment that is experiencing the greatest growth at the present time. Therefore, in a context of diversifying the tourism supply as means of adapting to climate change, it is considered essential to promote adaptation from different perspectives in this segment:

- Using interpretative media associated with cultural heritage as a vehicle for climate awareness and the communication of climate actions, including generating visibility of good practices.
- Analysing the needs for climate change adaptation in cultural tourism in Spain.
- Analysing mitigation-adaptation synergies in cultural tourism (for example, electric mobility reduces harmful vibrations for the built environment and also reduces pollution, which can damage heritage elements).

RESPONSIBLE ENTITIES AND COLLABORATORS

DG Fine Arts (MCD), Secretary of State for Tourism and SEGITTUR (State Trading Company for the Management of Innovation and Tourist Technologies, Ministry of Industry, Trade and Tourism, in Spanish - MINCOTUR), with the collaboration of OECC, autonomous communities and municipalities.

COMPLIANCE INDICATOR

Climate-adapted and low-carbon forms of cultural tourism are promoted and good practices in this field are given visibility.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved in the line of action.

I.10. ENERGY

Spain has a high potential for renewable resources, which places it in an advantageous position for the transition towards a emission-free energy system. The implementation of the measures envisaged in the updated draft of the National Integrated Energy and Climate Plan will increase the share of renewable energy in final energy use to 42% and reach 74% of renewable energy in electricity generation by 2030, laying the foundations for climate neutrality by 2050.

However, the potential impacts of climate change throughout this transition process need to be considered. Projections point to an increase in the average temperature and the progressive reduction of water resources in Spain. All studies anticipate a strong increase in the risk of droughts, which will be more frequent, longer and more intense, and floods, with more frequent swells and higher peak flows. Adverse weather events, such as heat waves or coastal phenomena, are also expected to be more frequent and could affect energy installations located on the coast.

These changes may have significant impacts on the projected energy model if the risks are not anticipated and the necessary adaptation measures are not analysed for incorporation into successive National Integrated Energy and Climate Plans.

One of the issues under consideration in the energy sector is the water-energy nexus. Some energy technologies require intensive use of water, which will become a scarcer resource due to climate change. Climate change will also have an impact on energy demand, changing the energy required for some uses, as well as on the temporal patterns of demand.

It is therefore essential to analyse and quantify the negative impacts of climate change on the energy system and to address with sufficient urgency the key actions to reduce the associated risks. The ultimate objective is to guarantee an energy system that is resilient to the effects of climate change in our territory in a scenario of rapid decarbonisation.

LINE OF ACTION 10.1. INTEGRATING CLIMATE-CHANGE-RELATED PRIMARY ENERGY SUPPLY VARIATIONS WITHIN ENERGY PLANNING AND MANAGEMENT**DESCRIPTION OF THE LINE OF ACTION**

Climate change is affecting the availability of renewable resources (wind, solar, hydro and biomass). Initial analyses point to a moderate increase in the solar resource and a certain tendency towards a decrease in the wind resource, although with significant territorial variations. However, the expected impacts are more relevant, and of a negative nature, in the hydro and biomass sectors:

- A significant reduction in hydroelectric production is expected as a consequence of reduced river flows.
- The productivity of biomass-oriented agricultural and forestry crops is also expected to decline due to reduced water availability.
- This line of action is aimed at:
 - Developing projections that make it possible to recognise, for various climate change scenarios, the availability of water resources and their generation potentials by river basin.
 - Developing projections of biomass potential by crop type and region for different climate change scenarios.
 - Using projections of possible changes in available resources in energy planning and management.

RESPONSIBLE ENTITIES AND COLLABORATORS

Secretary of State for Energy (MITERD) with the support of the IDAE (Institute for Energy Diversification and Saving, in Spanish), in collaboration with OECC.

COMPLIANCE INDICATOR

- An analysis of the hydroelectric and biomass production potential for various climate change scenarios is available.
- Projections of the hydroelectric potential are integrated into energy transition planning within energy planning.
- Projections of biomass production potential are integrated into energy transition planning in successive National Integrated Energy and Climate Plans.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved

LINE OF ACTION 10.2. PREVENTING THE IMPACTS OF CLIMATE CHANGE ON ELECTRICITY GENERATION

DESCRIPTION OF THE LINE OF ACTION

Changes in annual or seasonal patterns of precipitation, water and air average temperatures and average wind speeds can affect the performance and optimal operation of power plants.

This line of action is aimed at:

- Estimating the potential impacts associated with climate change by technology type and region.
- Identifying and analysing the technological improvements that promote the implementation of more resilient, efficient and adapted electricity generation facilities.
- Integrating the results into energy transition planning in subsequent National Integrated Energy and Climate Plans.
- Identifying the water resource needs for electricity generation.

RESPONSIBLE ENTITIES AND COLLABORATORS

Secretary of State for Energy (MITERD) with the support of the IDAE (Institute of Energy Diversification and Saving, in Spanish), in collaboration with OECC.

COMPLIANCE INDICATOR

- Studies are published on the potential impacts of climate change by technology type and region, and on the technological improvements required for the implementation of more resilient power generation facilities.
- The results are integrated into energy transition planning in subsequent National Integrated Energy and Climate Plans.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 10.3. PREVENTING THE IMPACTS OF CLIMATE CHANGE ON ENERGY TRANSPORT, STORAGE AND DISTRIBUTION

DESCRIPTION OF THE LINE OF ACTION

Changes in weather patterns, especially the increased frequency and intensity of extreme events, can damage the infrastructures essential for the proper functioning of electricity, gas or liquid fuel systems. As recent storms have demonstrated, damage particularly affects overhead power lines, but the increased risk to liquefied natural gas (LNG) and conventional gas terminals and refineries in coastal areas due to storms, sea surges and rising sea levels should also be considered.

This line of action is aimed at:

- Conducting analyses of the impact of climate change on the functionality and resilience of electricity transmission and distribution networks and defining the consequent adaptation measures.
- Identifying the energy infrastructures that are highly vulnerable to extreme events and promoting specific adaptation programmes.
- Integrating the results into energy transition planning in subsequent National Integrated Energy and Climate Plans.

RESPONSIBLE ENTITIES AND COLLABORATORS

OECC in collaboration with the Secretary of State for Energy (MITERD).

COMPLIANCE INDICATOR

- An analysis of the impact of climate change on the functioning and resilience of electricity transmission and distribution networks is available, as well as the relevant adaptation measures.
- The energy infrastructures that are highly vulnerable to extreme events are identified and specific adaptation programmes are in place.
- The results are integrated into the National Adaptation Plan Work Programmes and energy transition planning in the subsequent National Integrated Energy and Climate Plans and Electricity Transmission Grid Planning.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved

LINE OF ACTION 10.4. MANAGEMENT OF THE CHANGES IN ELECTRICITY DEMAND ASSOCIATED WITH CLIMATE CHANGE

DESCRIPTION OF THE LINE OF ACTION

Climate scenarios point to an increase in the number of days per year with high temperatures, which will lead to increased peak electricity demand associated with cooling needs at certain times of the day and during certain seasons. Without appropriate measures targeted at the most vulnerable sections of the population, there could also be an increase in seasonal energy poverty rates in certain regions associated with cooling needs.

This line of action aims to conduct the necessary studies to estimate the impact of changes in average and extreme temperatures on daily and seasonal electricity demand profiles by climate zones and to integrate the results into energy transition planning in successive National Integrated Energy and Climate Plans.

RESPONSIBLE ENTITIES AND COLLABORATORS

Secretary of State for Energy (MITERD) in collaboration with OECC and the Directorate General for the Urban Agenda and Architecture (MITMA).

COMPLIANCE INDICATOR

- An analysis is available on the impact of changes in average and extreme temperatures on daily and seasonal electricity demand profiles by climate zones.
- The results are integrated into successive National Adaptation Plan Work Programmes, energy transition planning in subsequent National Integrated Energy and Climate Plans and actions associated with the National Energy Poverty Strategy.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

I.11. MOBILITY AND TRANSPORT

As the European Strategy on Adaptation to Climate Change indicates the impacts of climate change on transport infrastructure will increase in the coming decades regardless of the effectiveness of climate change policies and measures. This makes it necessary to integrate resilience to climate change into the life cycle of infrastructures (designed to last 50 years or more), as well as to adopt adaptation measures to ensure their availability and operability facing the impacts, especially those arising from the increased intensity and frequency of certain extreme weather events, and minimising their economic, environmental and social costs.

In a broad sense, the resilience of transport infrastructures is not solely related to the operability of the main physical components – roads, railways, airports and ports – but also the ability of their managers and society to anticipate potential service disruptions and to take the necessary measures to minimise their negative effects. Therefore, the term transport infrastructure also includes networks, systems and equipment associated with information and communication technologies, data collection, early warning, etc.; representing any physical component, tool or system that provides a service for the transport and mobility of people and goods.

Furthermore, given the specific nature and extent of the impacts of climate change on land-based activities such as transport and mobility, adaptation measures need to address both ongoing and expected long-term effects and be adopted across all geographical scales and administrative levels – local, regional and national – as well as across multiple sectors of activity and in partnership with the private sector and affected communities.

Adapting infrastructure to change may require the modification of different aspects of infrastructure design and management. Firstly, in order to plan the measures to be implemented, a detailed review of each of area requiring adaptation measures is needed to assess the needs, the time frame and the cost. This work ranges from the possible redefinition of design and management standards to the physical adaptation of existing infrastructure.

Finally, it should be noted that the proper maintenance of transport infrastructure (routine inspections, maintenance of drainage systems, removal of vegetation and monitoring of structures and linear infrastructure slopes) is essential for ensuring its resilience. For this reason, conservation and maintenance actions play an important role in the adaptation of infrastructures.

LINE OF ACTION 11.1. SYSTEMS FOR THE OBSERVATION, MONITORING AND SURVEILLANCE OF INFRASTRUCTURE OPERABILITY

DESCRIPTION OF THE LINE OF ACTION

This line focuses on strengthening the knowledge of the climate variables affecting infrastructure, as well as the monitoring and evaluation of the impacts they cause.

Measures should be aimed at reviewing the climatic variables that affect the design of infrastructure and the thresholds above which interference with their operability occurs. To this end, it will also be necessary to review and, if necessary, reinforce the systems for observing the environmental variables that may affect the operability of the infrastructures. To complete this action, a review of the status of the systems for observation, transmission, storage, analysis, modelling and prediction of the operability of the infrastructures must be included, and a plan for their progressive reinforcement must be drawn up.

It will also be necessary to assess the suitability, capabilities and limitations of the Meteolaerta Plan and its thresholds for the needs of infrastructure managers so that improvements can be included in this area, where appropriate. For more information on the Meteolaerta Plan, see Line of Action 1.2.

Finally, all of this will make it possible to define a system of indicators of the impacts and vulnerability of infrastructures in the face of climate change, to be integrated into the Observatory for Transport and Logistics in Spain.

RESPONSIBLE ENTITIES AND COLLABORATORS

Secretary General for Infrastructures (MITMA), AEMET, Office of the Spanish Government Commissioner for the Mediterranean Corridor, autonomous communities in the scope of their competences and other Public Administrations in charge of infrastructures.

COMPLIANCE INDICATOR

- Climate variables affecting the design and operability of infrastructures are identified and impact and vulnerability indicators are defined.
- Systems for the observation, transmission, storage, analysis, modelling and prediction of the operability of infrastructures are reviewed, taking climate change into account.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 11.2. INTEGRATING THE EFFECTS OF CLIMATE CHANGE INTO TRANSPORT INFRASTRUCTURE DESIGN AND CALCULATION REGULATIONS**DESCRIPTION OF THE LINE OF ACTION**

This line focuses on actions concerning design regulations and standards, with emphasis on identifying, analysing and assessing the need to adapt the regulations, instructions and standards for the calculation and design of roads, railways, airport and port facilities, as well as the installations associated with these different infrastructures, in order to progressively adapt them.

It will also be necessary to promote the revision of landscape and vegetation restoration recommendations and practices, highlighting those aimed at avoiding disruptions to the national network of livestock trails and ecological corridors.

RESPONSIBLE ENTITIES AND COLLABORATORS

Secretary General for Infrastructures (MITMA), with the collaboration of DG Biodiversity, Forests and Desertification (MITERD), and autonomous communities within the scope of their competences.

COMPLIANCE INDICATOR

- A review of regulations, instructions, recommendations and good practices for the inclusion of climate change adaptation is carried out.

ARE REGULATORY INSTRUMENTS REQUIRED?

Yes, the assessment and possible revision of infrastructure design standards, instructions, general technical specifications, recommendations, good practice guides, etc., will be necessary.

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 11.3. EXISTING STRUCTURES: CLIMATE CHANGE RISKS IN THE MANAGEMENT AND MAINTENANCE OF TRANSPORT INFRASTRUCTURE

DESCRIPTION OF THE LINE OF ACTION

This line focuses on actions on existing infrastructures, specifically on the review and improvement of emergency and early warning systems, in order to identify the vulnerabilities of transport networks and their most critical sections. This will be done to adapt or develop contingency and operational plans, conservation and operating plans, as well as to develop adaptation plans based on the action priorities identified.

RESPONSIBLE ENTITIES AND COLLABORATORS

Secretary General for Infrastructures (MITMA), autonomous communities within the scope of their competences and other public administrations in charge of infrastructures, MINISDEF (Ministry of Defence, in Spanish) and DGPCE (MIR).

COMPLIANCE INDICATOR

- The vulnerability of networks is assessed and critical sections are identified.
- Contingency and operational plans are developed from an adaptation perspective.
- Climate change adaptation plans are drawn up for the different infrastructures.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 11.4. NEW STRUCTURES: CLIMATE CHANGE RISKS IN TRANSPORT INFRASTRUCTURE PLANNING

DESCRIPTION OF THE LINE OF ACTION

In the case of new infrastructures, it will also be necessary to develop a series of actions in the planning phase.

In this regard, a methodology for calculating the costs associated with climate change in the life cycle of infrastructures should be defined within the framework of this line of action. It will also be necessary to progressively integrate the consideration of climate change impacts on infrastructure, together with the adaptation to those impacts, into relevant strategies, plans, programmes and projects.

The special situation of island territories and their needs and dependencies will also be considered in infrastructure planning.

To complement this work, it is also important to reinforce research and innovation support programmes in construction engineering in order to develop climate-resilient elements and components.¹⁴⁵

At the level of global transport needs, it is interesting to study the possible modification of the major world trade routes, assessing the impact on existing transport networks and systems in Spain and medium and long-term planning (see Line T.3).

RESPONSIBLE ENTITIES AND COLLABORATORS

SG for Infrastructures, Office of the Spanish Government Commissioner for the Mediterranean Corridor, autonomous communities within the scope of their competences and other public administrations in charge of infrastructures (MITMA).

COMPLIANCE INDICATOR

- Estimates are made of the costs associated with climate change over the life cycle of infrastructure.
- R&D&i programmes are undertaken to develop new products and construction materials.
- Adaptation is included at the strategic and planning level.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

For more information, see Line of Action 16.3.

¹⁴⁵ - Para más información en este sentido, consultar la Línea de Acción 16.3.

LINE OF ACTION 11.5. SUPPORTING AND STRENGTHENING ADAPTATION TO CLIMATE CHANGE IN PUBLIC ADMINISTRATIONS AND OTHER SECTORS

DESCRIPTION OF THE LINE OF ACTION

Actions to be carried out in the field of mobility and transport should also be aimed at strengthening adaptation in other related areas, such as land management, land fragmentation, coordination with other public administrations in terms of infrastructures and mobility, training local authorities in this area, relationships with other areas such as tourism and communication with the public regarding possible contingency plans, etc.

To this end, it will be necessary to carry out measures such as the establishment, within the framework of the Safe, Sustainable and Connected Mobility Strategy, of a Working Group on the adaptation of transport infrastructures to climate change with representation from all public administrations.

To be able to conduct vulnerability assessments on transport infrastructures, a framework methodology must be designed, the use of which will be voluntary for public administrations. The development of good practice guides and guidelines for administrative and technical procedures in the preparation of documents (useful for MITMA and other public administrations owning infrastructure) will also be useful in this regard.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITMA, AEMET, MITERD, autonomous communities within the scope of their competences and other public authorities owning infrastructures.

COMPLIANCE INDICATOR

- A Working Group to consider the adaptation of infrastructures to climate change, with representation from all public administrations owning infrastructure, is set up.
- A framework methodology is defined for carrying out vulnerability assessments on transport infrastructure.
- Good practice guides and guidelines for administrative procedures are developed.

ARE REGULATORY INSTRUMENTS REQUIRED?

Yes

FUNDING

Regular budget of the organisations involved.

I.12. INDUSTRY AND SERVICES

The estimated impacts of climate change on the industrial and service sectors are very varied, ranging from damage to facilities, disruptions to supply chains, impacts resulting from reduced availability of certain resources (such as water) or alterations in industrial processes as a consequence of variations in production conditions (for example, increased ambient temperature, with effects on cooling systems). Moreover, responses to climate change will require new products, services and production processes aimed at avoiding or reducing current and future damage from climate change, which poses new opportunities and demands on the industrial and service sectors. Against this backdrop, the only possible way forward for these sectors is to move towards climate neutrality, while increasing their resilience to the impacts of climate change and enhancing their ability to contribute to adaptive responses. This process opens up a great opportunity to modernise, facilitate innovation and improve the competitiveness of the Spanish economy and, as a consequence, strengthen the industrial and technological fabric.

Some of the industrial and service activities particularly linked to climate change adaptation are integrated in specific areas of this National Adaptation Plan (such as transport, tourism, insurance, agri-food industry and energy). However, broader lines of work should be promoted to encourage the adaptation of industry and services as a whole, sectors which have significant weight in the Spanish economy and which also play a fundamental role in innovation and job creation in a context of ecological transition. In this respect, within the business sector linked to industry and services, the role of SMEs, which may have a high vulnerability to climate change but which also have a high potential to contribute to climate change responses, deserves special mention.

The Declaration of Climate and Environmental Emergency, adopted in January 2020, includes the commitment to promote, support and accompany the transformation of the Spanish industrial model and service sector, favouring the sustainability of economic activities and quality employment, and integrating environmental externalities, while fostering efficiency and innovation, as well as the compatibility of business strategies with environmental limits. All of this is to be achieved through Just Transition Agreements and accompanying measures for industries. The link between these areas and research is also highlighted through their inclusion in the Spanish Science, Technology and Innovation Strategy 2021-2027, which contains lines of innovation aimed at developing promising technologies that will boost industry and meet the challenge presented by climate change.

In this context, adaptation to climate change in industry and services should be integrated into sectoral legislation and industrialisation plans, while favouring

the generation of knowledge to identify the climate change risks for the Spanish industry, and promoting the adoption of adaptation measures. Finally, it is essential to establish mechanisms to encourage the generation of new adaptation-oriented products, services and processes.

LINE OF ACTION 12.1. INTEGRATING ADAPTATION INTO SECTORAL LEGISLATION AND INDUSTRIALISATION PLANS

DESCRIPTION OF THE LINE OF ACTION

The Declaration of Climate and Environmental Emergency, approved by the Spanish Government in January 2020, includes among its priorities the drafting of a new Industry Law and an Industrial Strategy. These proposals form part of the "General Guidelines for the New Spanish Industrial Policy 2030", which propose updating the industrial regulatory framework to meet the new challenges of digitalisation and decarbonisation, and an Industrial Policy Strategy for Spain 2030 that defines the measures needed to boost the growth of the Spanish industrial sector, improve its competitiveness and generate sustainable and inclusive growth. These Guidelines identify the adoption of appropriate measures to address the increased vulnerability to the physical impacts of climate change in the context of the ecological transition as one of the challenges to be addressed. Likewise, the Industrial Policy Line of Action on Sustainability (Line 9) proposes actions to strengthen the analysis of the vulnerabilities and strengths of businesses in relation to the ecological transition and climate change, with the aim of facilitating the early adoption of measures allowing opportunities to be seized, which may include the promotion of public plans to support industry.

In this sense, in order to reconcile industrial progress with sustainability, it is essential that climate change adaptation is included in these texts so that the industrial sector may benefit from it.

A further step will be to integrate adaptation into all other regulations and plans relating to industrial activity in order to increase its role in climate change adaptation and to develop appropriate supportive policy frameworks, with a special focus on SMEs.

RESPONSIBLE ENTITIES AND COLLABORATORS

Directorate General for Industry and Small and Medium-Sized Enterprises (MINCO-TUR).

COMPLIANCE INDICATOR

- Inclusion of climate change adaptation in the Industry Law and the Industrial Strategy.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 12.2. IDENTIFICATION OF RISKS TO SPANISH INDUSTRY AND THE SERVICE SECTOR ARISING FROM CLIMATE CHANGE AND THE PROMOTION OF ADAPTATION MEASURES**DESCRIPTION OF THE LINE OF ACTION**

Although specific knowledge already exists on some of the risks posed by climate change to certain sub-sectors of industry and services (such as transport, tourism and energy, which are covered by other areas of work in this plan), there is a need to further promote research on the risks and adaptation in other sub-sectors.

In the specific case of SMEs, the Strategic Framework in SME policy 2030 identifies sustainability as one of its areas or levers, and one of its lines of action (LA43 of the Strategic Framework) includes the promotion of information transfer and exchange actions that strengthen the capacities of businesses to improve their resilience to climate change, and the development of methodological guides for the integration of adaptation into business strategies in various sectors.

In this context, this line of work is aimed at the development of measures that promote the analysis of climate risks in the different sub-sectors of industry and the service sector in Spain. To this end, the development of tools and methodologies to facilitate self-diagnosis of the risks associated with climate change will be promoted, in line with the project known as the "ADAPTA" initiative. This project, developed in 2013 by the OECC, focused on the development of vulnerability analysis methodologies for a number of areas in the Spanish business sector, and represented a first approach to the climate change adaptation needs of the national private sector. Measures to build capacities in the use of existing tools and methodologies will also be carried out.

At the same time, the adoption of adaptation measures will be promoted by supporting the development of pilot projects aimed at managing the risks arising from climate change, as well as through the dissemination of case studies.

RESPONSIBLE ENTITIES AND COLLABORATORS

OECC, with the collaboration of DG Industry and SMEs (MINCOTUR) and other public administrations involved in the promotion and improvement of the industry and services sectors.

COMPLIANCE INDICATOR

- Tools and methodologies are developed for the self-diagnosis of climate change risks in different sub-sectors of industry and services, and training is provided for their use.
- Pilot projects are developed to manage the risks arising from climate change.
- Information on practical examples of adaptation carried out by industry and the service sector is disseminated.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved, PIMA Adapta and other sources of funding.

LINE OF ACTION 12.3. STIMULATING THE GENERATION OF NEW PRODUCTS, PRODUCTION PROCESSES AND ADAPTATION-ORIENTED SERVICES

DESCRIPTION OF THE LINE OF ACTION

Mainstreaming adaptation means offering new products and services to increase the resilience of society: from environmental technologies to building materials and insulation. The development of innovative services to facilitate the adoption of adaptation measures in different areas should also be promoted, from knowledge of climate change projections to advice for businesses on the development of concrete measures.

It will also promote an increase in the degree of self-sufficiency and independence with regard to products and services of a basic or strategic nature.

As stated in the Declaration of Climate and Environmental Emergency, the Spanish Science, Technology and Innovation Strategy 2021-2027 will include lines of innovation aimed at developing promising technologies to boost an industry sector that can meet the challenge of climate change. To promote the industry's contribution to addressing climate change risks, it is essential that this objective is specifically addressed and developed in future science, technology and innovation strategies and plans. This will be framed within the integration of adaptation into these future strategies and plans, which is already set out in this National Adaptation Plan (line of action 16.1. Integration of adaptation into future science, technology and innovation strategies and plans).

Furthermore, this line of action includes the dissemination of success stories in the application of new adaptation-oriented products and services, with the aim of raising awareness among actors working in the different fields of adaptation.

RESPONSIBLE ENTITIES AND COLLABORATORS

OECC, with the collaboration of DG Industry and SMEs (MINCOTUR) and the Ministry of Science and Innovation.

COMPLIANCE INDICATOR

- The development of new technologies, products and processes aimed at adapting industry and services to climate change is included in the Spanish Science, Technology and Innovation Strategy 2021-2027. Dissemination of case studies on the implementation of new adaptation-oriented products and services.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

I.13. TOURISM

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Tourism is one of the most important economic sectors in Spain. Spain's natural, architectural, cultural and gastronomic heritage, a modern network of infrastructures and services and its attractiveness as a holiday and leisure destination, largely thanks to its favourable climatic conditions, are the driving force behind Spain's leading position as a tourist destination. In 2018, the number of people affiliated to Social Security connected to tourism amounted to 2.4 million, 12.2% of the total, a figure that reflects its importance in the national economy.

It is a highly internationalised sector (82 million international visitors in 2018), in which major European countries play a key role (the United Kingdom, France and Germany account for more than 50% of international visitors).

The burden on Spanish tourism resources and destinations is highly concentrated in the summer months. This season coincides with the holiday period of our main market – European visitors – and with the most intensive use of our main product, sun and beach tourism.

Tourism is a very dynamic sector, subject to frequent changes as a result of the emergence of new business models, changes in tourists' reasons for visiting or changes in the competition. Periods of stability are becoming increasingly shorter, requiring flexible strategies.

The Spanish tourism sector is sensitive to climate change, which affects four key aspects: tourism resources, tourism infrastructures, tourism supply and tourism demand, particularly affecting coastal and snow destinations.

Among the climate change trends in Spain that are most relevant to the tourism sector, the following are of note:

- Increase in temperature above the global average, which is more pronounced in the summer season, the high tourist season in most of Spain.
- Reduction in rainfall on the Iberian peninsula, especially in the summer and in the south, which, together with the increase in temperatures, is limiting the water resources available for certain tourist activities.
- Sea level rise, which affects resources and infrastructures along the coastline.
- Increase in the frequency and duration of heat waves and the number of tropical nights, the latter being particularly relevant on the Mediterranean coast due to the rise in seawater temperature, which may affect the climate comfort of visitors.

Adaptation to climate change in the tourism sector involves recognising the risks involved, protecting the natural and cultural resources that contribute to tourism attractiveness, and moving towards more sustainable and climate-resilient tourism models.

LINE OF ACTION 13.1. INTEGRATING ADAPTATION INTO PLANS, PROGRAMMES AND STRATEGIES IN THE FIELD OF TOURISM

DESCRIPTION OF THE LINE OF ACTION

The Spanish Government, through the Secretary of State for Tourism, is currently drafting the Sustainable Tourism Strategy for Spain 2030, a national tourism agenda to address the challenges of the sector in the medium and long term and promoting three pillars of sustainability: socio-economic, environmental and territorial. A participatory process has been encouraged in the drafting of the document, in which the tourism sector and autonomous communities are involved.

This line of action is aimed at integrating adaptation to climate change into the Sustainable Tourism Strategy, incorporating the most relevant trends in climate change into the diagnostics that will serve as a basis for defining the Strategy and integrating the climate change adaptation approach into the new public policies to be defined and promoted.

This line of action extends efforts to integrate climate change adaptation into other relevant plans, programmes and strategies of the tourism sector.¹⁴⁶

It is important that effort in this field is shared with autonomous communities and local entities, creating interdepartmental and intersectoral working spaces to tackle adaptation in the tourism sector and promoting inter-administrative coordination.

It is also necessary to consider that solutions need to be implemented at different levels (destination, business and project) and that they require the participation of the tourism industry.

RESPONSIBLE ENTITIES AND COLLABORATORS

Secretary of State for Tourism and SEGITTUR (MINCOTUR), in collaboration with OECC, autonomous communities and municipalities.

¹⁴⁶ - One example is the Smart Tourist Destinations initiative that has been promoted by the Secretary of State for Tourism, through SEGITTUR, for several years, and in which more than 73 local entities representing tourist destinations throughout the country are already participating.

COMPLIANCE INDICATOR

- Climate change is integrated into tourism laws, regulations, plans and strategies.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 13.2. PROTECTING TOURISM RESOURCES, ADAPTATING INFRASTRUCTURES AND FACILITIES AND PROMOTING THEIR RESILIENCE TO THE EFFECTS OF CLIMATE CHANGE

DESCRIPTION OF THE LINE OF ACTION

Tourist resources are those natural or cultural elements located in tourist destinations that are likely to attract tourists. Among the tourism resources potentially affected by climate change, it is possible to distinguish:

- Natural resources: natural landscapes and monuments, natural and national parks, biosphere reserves, geoparks, well-preserved coastal and mountain areas, etc.
- Cultural resources: monuments, historic centres, archaeological sites, cultural landscapes, etc.

Tourism infrastructures can be understood as the collection of constructions and services used by tourism to boost its activity.

This line of action is aimed at identifying, planning and developing adaptation initiatives to protect tourism destinations and resources, as well as promoting the resilience of infrastructures and facilities, with a special focus on traditional tourism resources. The adaptation initiatives needed for these purposes are linked to other PNACC lines of action, including:

- Line 4.2. Adaptive planning and management of protected areas.
- Line 7.4. Development of adaptation initiatives in the Maritime-Terrestrial Public Domain.
- Line 9.1. Integration of climate change risks in the conservation of cultural heritage.

- Line 9.3. Promotion of responsible, climate change-adapted and low-carbon cultural tourism.
- Line 11.3. Existing structures: climate change risks in the management and maintenance of transport infrastructure.

Institutional coordination of the tourism sector with these other areas is therefore essential to ensure that the adaptation needs of tourism are incorporated into the planning and development of these initiatives.

For its part, the tourism sector can promote the adoption of measures that favour the incorporation of adaptive criteria for the protection of tourism resources, as well as the adaptation of infrastructures and facilities.

RESPONSIBLE ENTITIES AND COLLABORATORS

DG Coast and Sea, DG Biodiversity, Forestry and Desertification (MITERD), DG Fine Arts (MCD), Secretary of State for Tourism and SEGITTUR (MINCO-TUR), with the collaboration of the Spanish National Commission for Cooperation with UNESCO, OAPN, IGME, autonomous communities and local entities.

COMPLIANCE INDICATOR

- Measures for the protection of tourism resources and the adaptation of infrastructures and facilities are implemented in a wide range of destinations.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 13.3. DEFINITION OF MORE SUSTAINABLE TOURISM MODELS THAT ARE MORE RESILIENT TO THE IMPACTS OF CLIMATE

DESCRIPTION OF THE LINE OF ACTION

This line of action is aimed at reformulating the current tourism model, seeking models that are sustainable and that consider the carrying capacities of the destinations. This line can contribute to the overhaul of Spanish tourism in areas affected by obsolescence, as well as to its revaluation and innovative projection.

In a country heavily oriented towards sun and beach tourism, diversification of the tourism offer is one of the strategies that can increase the resilience of the sector. However, diversification requires a specific strategy, and it should be focused on the most vulnerable territories. In many areas, a process of diversification has already been observed, but it is characterised by unplanned development, with weak organisation and poor structuring of tourism products. Therefore, the potential of such diversification is not being adequately exploited.

Interventions to achieve this diversification could include, among others:

- Diversifying the economic activities in tourist areas, changing tourist activities (for example, from ski tourism to mountain tourism), redistributing tourist flows to untapped destinations (from coastal areas to inland), decreasing average length of stay and de-seasonalising sun and beach destinations.
- Promoting alternative tourism models to beach tourism: gastronomic, sports, cultural, leisure, rural, etc., and other economic options such as agriculture.
- Promoting sustainable tourism destinations and products, in line with the Sectoral Plan for Nature Tourism and Biodiversity.

It is therefore necessary to reinforce the collaboration between public administrations with competences in tourism and the private sector, the former creating intervention frameworks that favour long-term strategies and synergies.

RESPONSIBLE ENTITIES AND COLLABORATORS

Secretary of State for Tourism and SEGITTUR (MINCOTUR), in collaboration with MITERD, autonomous communities and local entities.

COMPLIANCE INDICATOR

- The touristic offer of the destinations most exposed and vulnerable to climate change diversifies to incorporate new activities that are well adapted to the ecological and climate features of the territory.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 13.4. GENERATING KNOWLEDGE, CAPACITY-BUILDING AND AWARENESS-RAISING ACTIONS IN TOURISM SUPPLY AND DEMAND**DESCRIPTION OF THE LINE OF ACTION**

Understanding the connections between climate change and tourism is essential when developing initiatives that promote the active role of the sector in implementing adaptation measures and building resilience. In the same way, this knowledge must be integrated into decision-making by strengthening the capacities of all key actors.

This line of action is aimed at knowledge generation, climate change adaptation and tourism management training to strengthen the sector's capacities. It includes the development of tools and the promotion of inspiring experiences, in collaboration with the different territories and main actors in tourism.

From the perspective of knowledge generation, it is necessary to study the impacts of climate change on tourism demand, both international and domestic. Some of the potential impacts of climate change in this field are the increase in domestic tourism in the countries of origin, which could lead to a reduction in tourism flows to our country (see line T.3, Cross-border effects); de-seasonalisation and a shortening of the average stay during high season in sun and beach destinations; an increase in demand in coastal areas in northern Spain; and an increase in inland tourism. In addition, the territorial and social vulnerability and risks faced by the different sub-sectors of tourism due to climate change should be further assessed, as well as the different adaptation options, furthering the studies already carried out within the framework of the PNACC on the impact of climate change on sun and beach, inland and winter tourism. It is also important that the studies consider the regional scale, so that their results and conclusions can be considered at the regional level.

It is also necessary to raise awareness of the risks that climate change entails for businesses in the tourism sector as a whole (hotel managers, tour operators, transport companies, etc.) and to train them in the design and implementation of adaptation strategies and actions. The capacity-building offer could include training actions for key actors, reinforcement of the content uploaded on the AdapteCCa platform, preparation of guides and manuals and other practical information in easily accessible formats. Other actions could include promoting awareness-raising campaigns for tourists.

RESPONSIBLE ENTITIES AND COLLABORATORS

Secretary of State for Tourism (MINCOTUR), OECC, in collaboration with autonomous communities and local entities.

COMPLIANCE INDICATOR

- Analyses are available on the potential effects of climate change on tourism demand.
- New risk studies and adaptation strategies are developed, focusing on specific sub-sectors of tourism.
- New resources are available for awareness-raising and training of key actors.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved , PIMA Adapta and other sources of funding.

I.14. FINANCIAL SYSTEM AND INSURANCE ACTIVITY

Achieving the goals of limiting the increase in average global temperature to 1.5°C, increasing adaptive capacity to the adverse effects of climate change and promoting climate resilience requires the alignment of all financial resources, both public and private. In fact, the Paris Agreement recognises, as its third major objective, that financial flows should be coherent with low-emission and climate-resilient development. To this end, it is essential that the financial system commits itself to the fundamental objective of ensuring long-term sustainability in an efficient manner.

The European Commission, through its Sustainable Finance Action Plan and its regulatory development, is working to make EU finance a key tool for the implementation of the 2030 Agenda and its Sustainable Development Goals, as well as the Paris Agreement, so that finance is not a marginal issue detached from the rules of market functioning, but a key element of decision-making.

Spain is actively participating in the development of the European Commission's Sustainable Finance Action Plan to ensure that financial flows are aligned and responsive to the objective of avoiding or limiting current and future damage from climate change and building a more resilient economy and society. In this way, it will also ensure that the Spanish financial system is prepared to participate in international markets with an increasing sustainability component, as well as to understand and reduce its exposure and vulnerability to the impacts of climate change, in both physical and financial terms, in the medium and long term.

The first steps have already been taken with the commitment – adopted in the government's climate and environmental emergency declaration – to ensuring the transformation of our public and private financial sector and its adaptation to the risks of the new climate-neutral model, while creating value in the medium and long term and ensuring the viability and stability of the system.

The Draft Climate Change and Energy Transition Law¹⁴⁷ establishes the framework to facilitate sustainable investments and allowing capital flows to be redirected, providing mandatory learning and transparency tools to help perceive and assess risks and opportunities as well as improve investment decisions.

A subsequent milestone will be the elaboration of a National Sustainable Finance Action Plan and a green bond programme by the Treasury. Coherence of public investments with the objectives of the Paris Agreement, as well as those related to trade and development cooperation policies, will also be promoted.

147 - http://www.congreso.es/public_oficiales/L14/CONG/BOCG/A/BOCG-14-A-19-1.PDF

In this context, the role of investors, in general, and the role of the insurance sector, in particular, in adaptation should be highlighted. Insurance is an important tool for climate change adaptation as it provides a means for risk transfer, increasing the ability to recover after damage caused by extreme weather-related events, among other things. It also has great potential for the promotion of risk reduction measures, contributing to increasing the resilience of society and strengthening the viability of strategic economic sectors that have to contend with the impacts of climate change. The role of the insurance sector as an institutional investor is also noteworthy for its potential to contribute to reducing risks and increasing funding for climate adaptation.

However, it is important to bear in mind that climate change entails variations in certain climate risks that could have negative impacts on the long-term sustainability of the insurance business itself. It is worth mentioning here that, in relation to the insurance of risks that may be potentially aggravated by climate change, Spain has two highly developed and well-established instruments: extraordinary risk insurance, which provides cover for insured goods and people, and combined agricultural insurance. Both instruments are based on the close collaboration between the private and public sectors, with entities such as the Insurance Compensation Consortium (CCS, in Spanish), responsible for the coverage of extraordinary risks (which includes climate-related events such as extraordinary floods and atypical cyclonic storms) and the State Entity for Agricultural Insurance (ENESA, in Spanish), which is the coordinating and liaison body for the development of agricultural insurance. These instruments put Spain in a comparatively better position than neighbouring countries, as they are flexible and holistic systems, with high penetration, involving all relevant actors. However, in order to cope with the increased risk expected as a result of climate change, flexibility will be required to help control the risk transferable to the insurer by managing exposure and vulnerability.

It is therefore essential not only to promote the role of insurance in adaptation, but also to assess the risks associated with climate change for the insurance sector, and to take the necessary measures for adaptation. In this context, it is necessary to stress that the insurance sector, in general, and the aforementioned institutions, in particular, should work closely with relevant institutions and sectors in risk management and risk reduction, especially the administrative levels responsible for spatial and urban planning, in other words, regional and local administration.

LINE OF ACTION 14.1. INCORPORATING CLIMATE CHANGE ADAPTATION INTO SUSTAINABLE FINANCE INITIATIVES**DESCRIPTION OF THE LINE OF ACTION**

Moving towards a climate-resilient society requires a significant mobilisation of resources and investments in various areas of action. The financial system must contribute to climate change adaptation and maintain financial stability in the long term, not only out of social responsibility but also for forward planning, as it, like all other sectors of the economy, is already being affected by climate change and must prepare for the changes to come. To this end, the finance sector needs to incorporate the assessment of the physical and transitional risks associated with the impacts of climate change.

Through the Sustainable Finance Action Plan and its regulatory development, European Union institutions are working on the involvement and participation of the financial sector in order to promote a change in the model of production to a more sustainable one.

Measures already in place at the European level include the Regulation on sustainability-related disclosures in the financial services sector,¹⁴⁸ the development of a common language for the identification of sustainable economic activities, in other words, a unified classification system (or taxonomy), established in an EU Regulation¹⁴⁹ to help investors and companies make investment decisions that contribute to the achievement of six environmental objectives, including adaptation to climate change. European legislation on sustainable finance also establishes disclosure obligations for financial information related to climate change for certain actors in the financial sector.

In recent years, many international¹⁵⁰ and national initiatives have been developed by the financial industry in order to react to this new reality and integrating sustainability criteria as a transversal element of its decisions.

148 - Regulation (EU) 2019/2088 of the European Parliament and of the Council, of 27 November 2019, on sustainability disclosures in the financial services sector.

149 - Regulation (EU) 2020/852 of the European Parliament and of the Council, of 18 June 2020, on establishing a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088.

150 - Some of the many initiatives in this regard are the Principles for Responsible Investment (with the UNEP Finance Initiative and the Global Compact - <https://www.unpri.org/>), the International Platform on Sustainable Finance (IPFS - <https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance>), the TCFD (Task force on Climate-Related Financial Disclosures - <https://www.fsb-tcfd.org/>), the Centre for Responsible and Sustainable Finance in Spain (Finresp) and the Academic Forum on Sustainable Finance in Spain.

Objectives include understanding the exposure to the effects of climate change, considering it as a fundamental element of business strategies.

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In the national sphere, it is worth mentioning that some progress has already been made, including the obligations derived from Law 11/2018 on non-financial information and diversity, and those foreseen in the Draft Climate Change and Energy Transition Law, which, through its Article 28, provides for the integration of climate change risk for credit institutions, insurance and reinsurance companies on the basis of their size and determines the content of such reports. Article 29 also provides that the Bank of Spain, together with the National Securities Market Commission and the Directorate General for Insurance and Pension Funds, will prepare a report on the assessment of the risk to the Spanish financial system arising from climate change.

In this context, this measure aims to continue working at the national level on mainstreaming climate change adaptation into sustainable finance initiatives as a key element to respond to the impacts of climate change, and to provide support to companies in order to improve knowledge on the evolving international and national framework on this issue.

RESPONSIBLE ENTITIES AND COLLABORATORS

OECC, DG Treasury (MINECO - Ministry of Economic Affairs and Digital Transformation, in Spanish), DG International Trade and Investments (MINCO-TUR), with the collaboration of member entities of the sustainable finance working group.

COMPLIANCE INDICATOR

- Adaptation is integrated into sustainable finance plans and programmes.
- Mechanisms are established to help companies comply with the adaptation recommendations of the main international and national sustainable finance initiatives.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 14.2. CREATION OF INCENTIVES FOR RISK PREVENTION BY INTEGRATING ADAPTATION INTO INSURANCE ACTIVITIES**DESCRIPTION OF THE LINE OF ACTION**

The insurance sector contributes significantly to climate change adaptation by strengthening the viability of the economic sectors affected by climate change and by limiting the social impacts. It is therefore essential to promote insurance as a key tool for adaptation in different socio-economic areas, while providing incentives for risk prevention by integrating adaptation into the insurance business and its policies, as well as other alternative financial instruments.

It is also necessary to consider its role as an institutional investor, from which it can contribute to reducing systemic risks and increasing financing for climate adaptation, by incorporating guidelines for reducing the risks associated with climate change into its investment mandates and policies.

This measure proposes to explore different possibilities for including climate change adaptation in the design of policies and strategies related to insurance business as well as the promotion of initiatives to prevent the risks associated with climate change in collaboration with other entities in the sector. The insurance sector can be a valuable source of accident rate data, but it also has the potential to become more proactively involved in reducing its risks by encouraging self-protection measures for policyholders and resilient reconstruction (build back better). Measures may include the development of materials and resources; prevention campaigns; preventive recommendations to insured groups, in general, and to groups affected by damage, specifically; the promotion of insurance for assets in clearly defined high-risk areas; the possible creation of specific funds for reducing catastrophic risks, etc.

RESPONSIBLE ENTITIES AND COLLABORATORS

OECC, OECC, CCS, with the collaboration of ENESA (the latter within the framework of agricultural insurance), and other public and private entities involved in insurance activity.

COMPLIANCE INDICATOR

- Adaptation to climate change is integrated into the main plans, programmes, and regulations developed in the field of insurance activity.
- Initiatives for risk prevention and adaptation to climate change are promoted in collaboration with key entities in the insurance business.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 14.3. PERMANENT FRAMEWORKS FOR COLLABORATION AND COORDINATION ON ADAPTATION WITH KEY ACTORS IN THE FINANCIAL SYSTEM AND INSURANCE BUSINESS

DESCRIPTION OF THE LINE OF ACTION

Achieving the proposed objectives requires the mobilisation of all actors involved in the financial system, especially in the insurance business. To this end, this line of action is aimed at consolidating permanent frameworks for collaboration and coordination on climate change adaptation between public institutions, private entities, academic institutions and other key agents in order to promote, among other things, the exchange of information and knowledge. These frameworks for collaboration may be formalised, where appropriate, by the definition and signing of specific agreements with the competent bodies in areas particularly vulnerable to the impacts of climate change.

These collaborative frameworks will seek to establish systems for the exchange and dissemination of finance, insurance and climate change indicators, which will provide an understanding of the evolving role of the financial and insurance sector in adaptation. They will also explore the different ways of using the information gathered in the field of insurance for the development of public policies and concrete measures related to climate change adaptation.

RESPONSIBLE ENTITIES AND COLLABORATORS

OECC, CCS, with the collaboration of ENESA (the latter within the framework of agricultural insurance), and other public and private entities involved in the financial sector and insurance business.

COMPLIANCE INDICATOR

- A permanent system of collaboration for the exchange and dissemination of insurance and climate change indicators is established.
- At least one collaboration and cooperation framework is established in order to make use of the information gathered in the field of insurance activity.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 14.4. CAPACITY BUILDING ON ADAPTATION IN THE FINANCIAL SYSTEM AND INSURANCE BUSINESS**DESCRIPTION OF THE LINE OF ACTION**

Understanding the connections between the activity of the financial system and climate change adaptation is fundamental when considering measures to promote the active role of the sector in the construction of a more resilient economy and society, as well as for the stability of the financial system. This knowledge must also be integrated into decision-making by strengthening the capacities of all key actors involved.

This line of action focuses on the promotion of training actions and the generation of knowledge, resources and tools on climate change adaptation in the financial system and insurance business, which will help to strengthen the capacities of the sector and to identify opportunities to contribute to climate change adaptation. In this regard, the vulnerability and impact of climate change, as well as the different adaptation options, should continue to be assessed in those branches of insurance activity that are most closely linked to climate risks. The development of specific tools aimed at identifying investment opportunities that contribute to climate change adaptation and informed planning in the sector, for example, specific models combining risk and financial parameters to recreate historical events and estimate possible future losses, will also be considered.

RESPONSIBLE ENTITIES AND COLLABORATORS

OECC, CCS, with the collaboration of ENESA (the latter within the framework of agricultural insurance) and other public and private entities involved in the financial sector and insurance business.

COMPLIANCE INDICATOR

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- Training actions and resources on climate change adaptation are coordinated with the sector.
- Knowledge on the risks and adaptation to climate change in the financial system and insurance business and on investment opportunities that contribute to climate change adaptation has been strengthened through specific assessments in at least one of the branches more closely connected to climate change.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

I.15. DISASTER RISK REDUCTION

There has been a significant increase in the number and severity of emergencies and disasters worldwide in recent decades. And it is predicted, as a result of climate change, that this trend will continue in the future, with longer-term and more far-reaching effects. Addressing the risks posed by these developments requires improved preparedness and an increasingly integrated approach to risk management.

There are a number of factors that interact with the effects of climate change and increase the impact of emergencies and disasters, these factors include demographics, driven by the increase in urban populations in environmentally hazardous areas and the decrease in other areas that are left unmanaged; the vulnerability of economic and technological infrastructure, which accentuates the speed and spread of risks and generates cascading effects; or the degradation of ecosystems, which reduces natural defences.

Spain is a country with a moderate overall level of risk. However, forest wildfires, floods, landslides, and risks arising from other adverse weather events, including coastal events, regularly cause significant damage, affecting the safety of people and their assets and contributing to the deterioration of the environment. In the last 20 years alone, more than 300 people have died due to flooding. In addition to these tragic effects on the population, there are consequences for different sectors of the Spanish economy, with damages estimated at an average value of 800 million euros per year in the case of floods alone.

Risk assessments are a primary tool for recognising the challenges and establishing the appropriate mechanisms for risk management, including the prevention of impacts, as far as possible.

Disaster risk policies also address a wide range of hazards, including natural and man-made disasters, health hazards, industrial risks and others. Some regions and sectors have developed valuable experience in relation to certain typologies of risks; sharing these experiences will facilitate better preparedness for future challenges.

There is broad consensus on the need for a coherent approach to climate change adaptation and disaster risk management, as exemplified by the number of countries that have developed joint strategies or have established processes that facilitate coordination between the two areas. Coherence requires strong leadership and commitment from key ministries, multi-level coordination, clear allocation of roles and responsibilities, resource allocation in line with agreed objectives, as well as continuous monitoring, evaluation and learning.

LINE OF ACTION 15.1. PROSPECTIVE DISASTER RISK ASSESSMENT CONSIDERING CLIMATE CHANGE PROJECTIONS AND SCENARIOS¹⁵¹

DESCRIPTION OF THE LINE OF ACTION

Adaptation to climate change shares many connections with disaster risk reduction and prevention. Improving knowledge of the main natural disaster risks through assessment contributes to addressing exposure and vulnerability to climate-related risks, and contributes to promoting resilience in Spain and to the implementation of the National Climate Change Adaptation Plan as a whole.

In line with the Sendai Framework, national risk assessments should strengthen their focus on the impacts of climate change on disaster risk in order to better address the underlying risk factors and, ultimately, to reduce exposure and vulnerability to the risks. Emphasising the climate perspective in disaster risk assessments can strengthen the contribution of climate change adaptation to disaster risk reduction and resilience building. Stronger links with climate vulnerability assessments would contribute to more robust risk assessments for different disaster types.

In this context, this line of action aims to conduct risk assessment studies in key areas, based on climate change projections and scenarios and supported by past records and analyses of natural hazards. This will allow priorities to be established in the implementation of adaptive disaster prevention, preparedness and response measures based on the risks and their economic impact, shortfalls in capacities, effectiveness and efficiency, taking into account possible alternatives.

The conclusions of these studies should be taken into consideration in the development and updating of the plans that make up the National Civil Protection System (territorial plans and special state-wide plans).

RESPONSIBLE ENTITIES AND COLLABORATORS

MIR, MITERD, MAPA, autonomous communities, with the collaboration of AEMET.

¹⁵¹ - This line of action, together with other instruments of the National Civil Protection System, will contribute to the fulfilment of Enabling Condition 2.4. on the Effective Disaster Risk Management Framework (as per final text agreed between the EU Council and the European Parliament on the proposed Regulation on Common Provisions for the European Structural and Investment Funds 2021-2027).

COMPLIANCE INDICATOR

- Prospective national disaster risk assessments are carried out, considering climate change projections and scenarios.
- The findings derived from these assessments are incorporated into the developments and updates of the plans that make up the National Civil Protection System.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 15.2. INTEGRATING ADAPTIVE CRITERIA INTO DISASTER RISK REDUCTION POLICIES AND MEASURES AND POST-DISASTER ACTIONS**DESCRIPTION OF THE LINE OF ACTION**

Risk management involves a set of actions of a complex nature, requiring the coordination of all public administrations. In Spain, competences in this area are distributed over three levels: the Central Administration, autonomous communities and local administrations, which act under the principles of solidarity, complementarity and subsidiarity.

Tackling current and future exposure and vulnerability to floods, droughts, storms, forest wildfires and other climate-related hazards through risk reduction measures requires a combination of structural and non-structural measures. As climate change could affect the effectiveness of these risk reduction measures, it is essential that this factor is incorporated into their prioritisation and design.

Therefore, this line of action aims to integrate adaptive criteria into the different instruments that contribute to the definition of a coordinated and efficient response by the administrations. These tools include, among others, the analysis of vulnerability conditions and potential threats, emergency planning and the projection of the human and material resources necessary for the protection of people and property in the event of an emergency.

It is also considered of vital importance to incorporate climate change adaptation into recovery actions aimed at restoring normality to the affected area after

the immediate response to the emergency has been completed. The adaptive approach should also be incorporated into assessments of the causes of the event (attribution studies) and its associated impacts, with the objective of incorporating the findings into regular risk planning and prevention.

RESPONSIBLE ENTITIES AND COLLABORATORS

MIR, MITERD, MAPA, autonomous communities and local entities.

COMPLIANCE INDICATOR

- The main policy instruments and measures for disaster risk reduction, revised or new, incorporate adaptation to climate change.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved and European funds.

LINE OF ACTION 15.3. SUPPORTING AND REINFORCING DISASTER RISK PREPARATION: OBSERVATION, EARLY WARNING, COMMUNICATION AND EDUCATION WITH CLIMATE CHANGE ADAPTATION CRITERIA

DESCRIPTION OF THE LINE OF ACTION

Disaster risk preparedness includes the knowledge and capacities of governments, professional response and recovery organisations, communities and individuals, in order to anticipate, effectively respond to and recover from the impacts of likely, imminent or current hazardous events or conditions. Improving resilience is a common objective of preparedness measures.

Observation and early warning systems can act as a link between disaster risk policies and climate change adaptation when used to raise awareness and build capacities, emphasising the increased risks associated with climate change. Strengthening early warning systems and their adaptation to climate change is also closely connected to improving weather observation and the communication of weather warnings (see Line of Action 1.2).

Fragmented and incomplete records of the impacts of past disasters on assets, cultural heritage, economies, ecosystems and human health are of limited usefulness for disaster risk preparedness. In contrast, comprehensive, harmonised and interoperable databases of disaster losses contribute to improving existing damage models. Therefore, the implication of statistical offices, national meteorological and hydrological services and civil protection authorities in data standardisation, quality assurance and data accessibility is important.

In addition, the integration between climate change adaptation and risk management should be systematically incorporated into public communications, consultation with interested parties and education programmes related to disaster risk. Municipalities and other administrations should increase their activity in public education campaigns in order to raise awareness of the risks, developing campaigns to improve resilience.

RESPONSIBLE ENTITIES AND COLLABORATORS

MIR, MITERD, MAPA, autonomous communities, local entities, with the collaboration of AEMET.

COMPLIANCE INDICATOR

- Instruments related to disaster risk preparedness (observation, early warning, communication and education), revised or new, incorporate the climate change adaptation perspective.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved and European funds.

LINE OF ACTION 15.4. STRENGTHENING SELF-PROTECTION MEASURES FOR CLIMATE DISASTERS IN AT-RISK COMMUNITIES

DESCRIPTION OF THE LINE OF ACTION

Self-protection systems and understanding how to act in adverse situations are considered essential in reducing the consequences of disasters. These systems consist of management and organisational procedures with the primary purpose of ensuring the maintenance of previously defined safety conditions and a

and a minimum emergency response structure, with the particularity that it is generally the population itself (individuals or organisations) that are responsible for these measures and not the public administrations. However, the administrations usually study and recommend the self-protection measures considered most appropriate for each risk, providing, where necessary, training and technical or financial support for their uptake by interested parties.

Self-protection measures depend on the type and category of the risk, so these aspects must be identified before the self-protection measures can be defined. Recognising the circumstances that condition risk requires the analysis of various aspects, and these rarely include climate change.

This line of action, therefore, aims to promote the consideration of climate projections in the study, analysis and definition of self-protection measures and the promotion of their development for the different disaster risks related to climate change.

This line of action is closely linked to line 17.4, which focuses on capacity building for communities so that they may actively participate in collective risk prevention and management processes.

RESPONSIBLE ENTITIES AND COLLABORATORS

MIR, MITERD, MAPA, autonomous communities and local entities.

COMPLIANCE INDICATOR

- The revision or development of self-protection systems is promoted, taking into account the risks associated with climate change.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

I.16. RESEARCH AND INNOVATION

Adaptation to climate change poses major challenges in the field of knowledge, both in terms of its physical basis and its social components. Research on the costs, impacts, risks and adaptation to climate change, carried out by public and private actors, has made remarkable progress in Spain in recent decades. A bibliometric study conducted within the framework of the LIFE SHARA project concluded that, between 1996 and 2016, a total of 3,530 citable works had been published in these subject areas with the participation of Spanish authors, with a high percentage in recent years (67%) being the result of international collaborations.

Horizon Europe, the European Union Research and Innovation Investment Programme for the period 2021-2027, sets among its objectives, "tackling climate change, helping to achieve the UN's Sustainable Development Goals and boosting the EU's competitiveness and growth". (A budget target of 35% of the total budget is allocated for tackling climate change.) Within Horizon Europe's Pillar II, Global Challenges and European Industrial Competitiveness, it is worth highlighting Cluster 5 which addresses "Climate, Energy and Mobility" and whose main objectives are to promote climate action and improve the competitiveness of the energy and transport sectors, as well as the quality of their services, for which it is necessary to better understand the causes of climate change, its evolution, risks, impacts and opportunities, and to make energy and mobility systems climate and environmentally friendly, more resilient, safer, smarter, more efficient and more inclusive. Furthermore, Cluster 6 of the Programme addresses "Food, bioeconomy, natural resources, agriculture and environment" and aims to increase knowledge, expand capacities and offer innovative solutions to accelerate the transition towards the sustainable management of natural resources, including measures for climate adaptation and supporting the shift to a competitive, more circular and climate-neutral economy.

For its part, the future Spanish Strategy for Science, Technology and Innovation 2021-2027 also includes "placing science, technology and innovation at the service of achieving the SDGs and social, economic and environmental development".

In this context, and considering the transversal nature of climate change adaptation and the current distribution of R&D initiatives, it is necessary to improve the coherence and coordination of different lines of research and research centres. It is therefore proposed to create a participatory forum made up of both men and women, capable of identifying and highlighting the knowledge generated by the extensive network of research and technology transfer centres in our country and of assessing the progress of research and innovation in a more systematic way. In addition, it is necessary to give continuity to the lines of research developed in relation to climate change adaptation within the current Spanish

Strategy for Science, Technology and Innovation, which already includes "research on the impact and vulnerability to climate change" as one of its objectives.

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Finally, there is a need to continue facilitating the participation of Spanish researchers in the IPCC, as a way of supporting the strategic role played by this organisation in the evaluation of knowledge on climate change generated at the international level, and with the added objective of ensuring that the reports produced reflect the work and particularities of our geographical environment.

LINE OF ACTION 16.1. INTEGRATING ADAPTATION INTO FUTURE SCIENCE, TECHNOLOGY AND INNOVATION STRATEGIES AND PLANS

DESCRIPTION OF THE LINE OF ACTION

The State Science, Technology and Innovation Plans 2021-2024 and 2025-2027 will be developed based on the Spanish Science, Technology and Innovation Strategy 2021-2027, which is currently under preparation. This Strategy is the instrument that considers R&D&i activities from a general perspective, bringing together national and regional elements, and it is closely aligned with the EU research and innovation programme, Horizon Europe, and the 2030 Agenda for Sustainable Development.

Adaptation to climate change as an area for science and innovation should be considered as a transversal element of the Spanish Science, Technology and Innovation Strategy, and it should be developed through corresponding plans, particularly the future Strategic Action on Energy and Climate.

Adaptation to Climate Change is currently included in Challenge 2, Bioeconomy, and Challenge 5, Climate Change and Use of Natural Resources and Raw Materials, of the State Plan for Scientific and Technical Research and Innovation 2017-2020. The thematic priorities for R&D&i under Challenge 5 include "research on the impacts and vulnerability to climate change and adaptation processes to changes in climate behaviour in all three climate domains (atmospheric, oceanic and terrestrial), particularly high-biodiversity areas, coasts, forests, agriculture, fisheries and marine ecosystems, water resources, soils, health, tourism, cultural and natural heritage, transport, industry and energy". Therefore, the aim is to provide continuity and follow-up to these lines of research in the planning of the Ministry of Science and Innovation.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, DG for Research Planning (Ministry of Science and Innovation).

COMPLIANCE INDICATOR

- Climate change adaptation is integrated into future science, technology and innovation strategies and plans.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 16.2. STRENGTHENING OR PROMOTING THE CREATION OF SPACES/NETWORKS FOR EXCHANGE, COLLABORATION AND COORDINATION BETWEEN RESEARCHERS AND OTHER STAKEHOLDERS INVOLVED IN ADAPTATION**DESCRIPTION OF THE LINE OF ACTION**

Given the transversal nature of climate change adaptation, knowledge generation in this area is being addressed by many different sectors of research and innovation. Furthermore, the many adaptation initiatives being promoted in the different areas of work require a solid knowledge base, as well as innovative options in order to respond to the challenges posed by climate change.

For this reason, it is essential to bring together the different agencies developing lines of research in this field and those that are fostering innovation and transfer to society. In this sense, it is proposed to organise regular meeting spaces to exchange relevant information on new knowledge on adaptation from different disciplines, favouring the alignment between the knowledge needs of the actors involved in adaptation and the lines of research and innovation under development, and catalysing the creation of synergies between the different stakeholders.

This line of action aims to strengthen, specialise and aggregate research for knowledge generation on climate change adaptation, as well as to stimulate the transfer and management of the knowledge generated through the coordination promoted in these spaces/networks.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, Ministry of Science and Innovation, Ministry of Universities, autonomous communities and local entities.

COMPLIANCE INDICATOR

There are spaces/networks for exchange, collaboration and coordination between research staff and the different actors involved in adaptation.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 16.3. SUPPORTING THE PARTICIPATION OF SPANISH RESEARCHERS IN THE IPCC AND THE DISSEMINATION AND TRANSFER OF THE CONTENTS OF ITS IMPACTS, VULNERABILITY AND ADAPTATION REPORTS

DESCRIPTION OF THE LINE OF ACTION

The Intergovernmental Panel on Climate Change (IPCC) is a United Nations body whose objective is to provide governments with an assessment of the best available climate change science for the development of climate policies, including the physical basis of climate change, its impacts, adaptation and mitigation. To this end, the IPCC conducts periodic assessments of the state of climate change science through the work of scientists nominated by IPCC member parties.

This line of action is aimed at:

- Supporting the collaboration of Spanish researchers in the creation of IPCC reports through financial support to cover the expenses generated by their participation and through the dissemination of IPCC calls for proposals among Spanish authors, research centres and universities.
- Distributing the conclusions and findings of the different IPCC reports through different actions depending on the target group: administration, private sector, civil society organisations and the general public. This communication will be done through informative events and the preparation and publication of summary guides for IPCC reports and seminars.

- Transferring the knowledge contained within IPCC reports to the main interested actors (private sector, administration, civil society organisations). For this purpose, working groups may be formed with interested parties, with the primary objective of examining how the findings of the IPCC reports can be applied in Spain.

RESPONSIBLE ENTITIES AND COLLABORATORS

OECC, Ministry of Science and Innovation, Ministry of Universities, with the collaboration of AEMET.

COMPLIANCE INDICATOR

- Spain maintains a number of experts participating in the forthcoming IPCC assessment cycle in line with our scientific output.
- Information events are developed and dissemination materials are produced that reflect the main findings of the IPCC reports.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 16.4. DEVELOPING METHODOLOGIES AND TOOLS FOR THE ESTIMATION OF CLIMATE CHANGE RISKS AND INFORMED DECISION-MAKING FOR ADAPTATION

DESCRIPTION OF THE LINE OF ACTION

Climate change projections allow us to estimate the features of the future climate for different greenhouse gas emissions scenarios. In this way, it is possible to analyse possible trends and developments in climate change. However, concrete adaptation measures require the adequate identification of the potential impacts of future changes in the climate.

Research on climate change impacts includes the development of transdisciplinary analyses to identify the complex interactions between biophysical and socio-economic processes. This knowledge framework enables the investigation of the cause-effect chains linking climate and its impacts, using global and regional climate models, as well as physically-based impact models applied to various

natural and social sectors. The application of these impact analysis methodologies allows for the identification, theoretical testing and prioritisation of adaptation options and policies.

Climate change projections are used as input for impact models with the objective of estimating potential regional changes in variables such as water availability and droughts, crop yields, coastal flooding, energy supply and demand, ground movements and other geological disasters, among others. These changes can then be assessed in terms of their economic and social costs, including, for example, the number of people threatened by extreme temperatures or floods, allowing for an assessment of the costs of inaction and an estimation of the costs and benefits of adaptation options.

This line of action is aimed at the improvement and promotion of these methodologies and tools by the actors involved in adaptation in Spain, based on the necessary multidisciplinary collaboration between research centres and managers so that the knowledge developed is practical and applicable in decision-making.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, Ministry of Science and Innovation and other public and private entities involved in adaptation.

COMPLIANCE INDICATOR

- Methodologies and tools are developed or updated for the estimation of climate change risks in the main PNACC areas of work and, as a minimum, for water resource availability and droughts, river flooding and climate change risks on the coast.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved, PIMA Adapta and other sources of funding.

I.17. EDUCATION AND SOCIETY

Adaptation to climate change is, at its core, a societal challenge. Human societies are the ones that must change, by introducing the necessary transformations and adjustments to address the risks. But, at the same time, climate change itself may affect the ability of societies to respond to the challenges posed, as it may affect social structure through phenomena such as increased inequalities, with a potential loss of social cohesion,¹⁵² or loss of the capacity to adapt to climate change due to its reduced predictability.

The unified adaptation of a society to climate change requires the coordinated use of different types of risk management measures. In addition to physical, institutional or management measures, it is essential to promote measures associated with education, training and social organisation that build capacities, empower and facilitate the involvement of individuals and communities in the construction of collective responses to climate change.

Moving towards the adoption of more sustainable and resilient choices in sectors such as transport and mobility, housing, food, leisure and the consumption of other goods and services cannot be considered a matter of personal choice; public policies can facilitate and encourage or, conversely, hinder and discourage certain collective and individual choices, that define how we live and interact with others and with our environment. Promoting climate-resilient and climate-adapted lifestyles allows us to move away from an approach based on the promotion of specific behaviours, which is often presented in an uncoordinated and sometimes contradictory manner, towards more structured, coherent and aggregated choices, which provide greater stability in terms of changes and allow for better use of the synergies between the new adopted options.

Adaptation also has profound implications in the workplace and societal responses to climate change are leading to transformations in the labour market. The range of professions affected is very broad, as all professions, to a greater or lesser extent, involve energy consumption and emissions, and they must all adjust and respond appropriately to climate change.

It is important that job skills include these new competences, so that both the Vocational Training in the Education System, which trains future professionals, and Vocational Training for Employment, which trains employees, can anticipate these expected changes in the labour market.

¹⁵² - See Line of Action T.2. Social vulnerability.

The mainstreaming of adaptation (and mitigation) responses will require the transversal incorporation of competences into professional profiles, enabling professionals to perform their functions with climate change adaptation (and low-carbon) criteria.

Adaptation to climate change also requires adjustments in the skills required for professionals in those labour sectors that are directly related to the use of natural resources.

Adaptation to climate change can also have two positive effects on employment that should be explored: prevention of job losses by limiting the impacts of climate change, and the creation of new professional profiles associated with the adaptation initiatives themselves.

LINE OF ACTION 17.1. INTEGRATING CLIMATE CHANGE ADAPTATION INTO THE FUTURE ACTION PLAN FOR ENVIRONMENTAL EDUCATION FOR SUSTAINABILITY

DESCRIPTION OF THE LINE OF ACTION

The Action Plan for Environmental Education for Sustainability (PAEAS, in Spanish) was created with the general objective of defining the strategic lines of environmental education in Spain for the period 2021-2025, offering a mutually agreed working framework that reflects the strategic areas of action, as well as the objectives, main measures and specific actions to be developed by the different sectors and agents involved.

The PAEAS includes the following objectives:

- Promote the involvement of different sectors and social agents in the processes of cultural change – through education, communication, training and environmental participation – that the ecological and energy transition will entail in the next decade.
- Support, using the social tools of environmental education, the development and fulfilment of the environmental policies that the Spanish Government must promote in line with its international commitments.

The plan will be structured in a series of areas of work, based on thematic areas (climate change and energy transition; economy, lifestyles and living conditions and health; biodiversity conservation), territorial areas (rural and urban environment) and transversal areas (governance and training and professional development). These areas will be approached from the perspective of ten sectors (Central Administration; autonomous communities; local administrations; private sector including businesses/foundations; environmental associations, social organisations

and trade unions/citizens' movements; environmental education professionals and environmental facilities; media and social networks; protected natural areas; formal education and parents' associations; universities).

The aim of this line of action is to ensure that climate change adaptation is fully integrated into the definition and development of this plan, which is currently under preparation.

RESPONSIBLE ENTITIES AND COLLABORATORS

CENEAM and FB, with the collaboration of OECC.

COMPLIANCE INDICATOR

- The PAEAS fully integrates adaptation to climate change in its thematic areas.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 17.2. PROMOTING EDUCATION FOR SUSTAINABILITY IN THE FORMAL EDUCATION SYSTEM IN THE FACE OF THE CHALLENGES OF CLIMATE CHANGE

DESCRIPTION OF THE LINE OF ACTION

Education is a key element in the creation of adaptive capacities. The formal education system, in its different pathways, must play an essential role in the generation of skills and responsibility for a climate-adapted technical and professional practice, as well as for the adoption of habits and lifestyles that are resilient to the risks associated with climate change.

In order to ensure that education plays a strategic role as an adaptation mechanism, it will be necessary to undertake a series of different actions, including the detection of new training needs, the initial and ongoing training of teachers on climate change at different educational levels and the inclusion of sustainability criteria in the accreditation of qualifications or in the selection of education professionals.

In vocational training, it will be necessary to incorporate the need for climate change adaptation and sustainability as a transversal competence into the catalogue of qualifications, adjusting the professional profile in those qualifications whose professional areas are most closely linked to the use of natural resources, and designing new qualifications that respond to the detection of new professional skills.

RESPONSIBLE ENTITIES AND COLLABORATORS

Ministry of Education and Vocational Training, Ministry of Science and Innovation and the Ministry of Universities, with the collaboration of OECC and the autonomous communities.

COMPLIANCE INDICATOR

- The training needs for adaptation are analysed in the different areas of the formal education system.
- Changes are introduced in the educational curricula in order to respond to the identified needs.
- Climate change issues are included in initial university teacher training programmes and in programmes at teacher training centres in autonomous communities.

ARE REGULATORY INSTRUMENTS REQUIRED?

In some cases, policy instruments may be required (for example, changes in the policy framework defining the curriculum at the different levels of education).

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 17.3. CONTINUOUS TRAINING OF TECHNICAL AND PROFESSIONAL STAFF ON ADAPTATION

DESCRIPTION OF THE LINE OF ACTION

Many technical and professional staff work in economic or administrative sectors that will have to incorporate climate change adaptation criteria.

The list is extensive and includes professional groups from sectors as diverse as food production, ecological restoration, urban planning and housing, human health and education.

This line of action will be developed, whenever possible, through existing structures for the continuous training of workers, which should incorporate training actions into their programmes that respond to the needs of a technical and professional exercise with adaptation criteria.

In vocational training, adaptation to climate change will be included as an element of study in the observation of qualifications and their evolution.

The revision of the presence of this element and its treatment in the National Catalogue of Professional Qualifications (CNCP, in Spanish) will allow for the inclusion of competences related to the need for adaptation to climate change and sustainability.

This review will contribute to the adjustment of those professional qualifications and certificates in the professional areas most closely linked to the use of natural resources, and to the design of new professional certificates that respond to the detection of new professional skills.

Furthermore, the inclusion of assessment criteria related to climate change adaptation and sustainability will be strengthened in Assessment and Accreditation Processes for the competence.

The line of action will include the creation and promotion of horizontal learning methods (networking and self-learning for technical and professional staff).

RESPONSIBLE ENTITIES AND COLLABORATORS

MEFP, INAP (National Institute of Public Administration, in Spanish - MPTFP, Ministry of Territorial Policy and Public Function, in Spanish), training centres of ESF+ ministries and intermediate bodies, with the collaboration of OECC and the autonomous communities.

COMPLIANCE INDICATOR

- Vocational qualifications are reviewed, identifying the changes needed to respond to climate change adaptation and sustainability.
- There is a wide range of continuous adaptation training available for a wide range of public employees and technical and professional staff in the private sector.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

European Social Fund +, LIFE Programme.

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LINE OF ACTION 17.4. ADAPTATION COMMUNITIES

DESCRIPTION OF THE LINE OF ACTION

Some communities and population groups are particularly vulnerable to certain climate-related hazards. This is the case for people living in areas at high risk of flooding or in forest-urban interface areas at high risk of wildfire.

Individuals and communities in these circumstances require specific training in order to address the specific risks that affect them; training that should include both preventive and self-protection aspects in the case of imminent risks.

Through this line of action, affected human groups will be empowered to actively participate in collective risk prevention and management processes (for example, flood risk management plans or wildfire prevention and management plans).

RESPONSIBLE ENTITIES AND COLLABORATORS

Hydrographic confederations, authorities responsible for wildfire prevention and management, DGPCE (MIR), with the collaboration of OECC.

COMPLIANCE INDICATOR

The most affected communities have access to training and avenues for participation so that they may contribute to risk prevention and management processes.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 17.5. PROMOTING RESILIENT AND CLIMATE-ADAPTED LIFESTYLES

DESCRIPTION OF THE LINE OF ACTION

Measures to promote resilient and climate-adapted lifestyles aim to encourage individuals to make choices that are as coherent as possible, shaping a sustainable and climate-adapted lifestyle, within the possibilities and constraints of their specific life context. It is therefore essential to adopt a values-based approach, highlighting the real co-benefits of new choices in areas such as health and well-being, highlighting the contributions of these lifestyle changes to climate action, and encouraging people to make changes that are consistent with their own identity and motivations.

In order to promote sustainable and resilient lifestyles, it can be useful to identify options and behaviours that open up new possibilities for change and leverage adaptation to climate change. From a more global perspective, it will be necessary to analyse current trends in climate-relevant lifestyles in Spain, and to identify effective policies and measures for the promotion of those sustainable and climate-resilient lifestyles. In this sense, research and social innovation on lifestyles will play a very relevant role in this line of action.

Integrating the climate change adaptation component into planning for the promotion of sustainable and healthy lifestyles will also be a key element in addressing adaptation in coherence with other aspects driving the ecological transition.

In addition, concrete actions that encourage specific behavioural changes with high potential for changing attitudes and increasing the resilience of society, both in general and in particularly vulnerable groups, and that promote the "viral effect" of such lifestyles will be supported or promoted. This will include communication and educational campaigns, dissemination of practical examples, stimulating supply and demand (public and private) for sustainable products, deactivating potential barriers to change, and promoting truthful and responsible commercial advertising.

RESPONSIBLE ENTITIES AND COLLABORATORS

OECC, Ministry of Education and Vocational Training, Ministry of Consumer Affairs, with the collaboration of IM (Women's Institute, in Spanish).

COMPLIANCE INDICATOR

- An analysis of the role of lifestyles in climate change adaptation is available and policies and measures for the promotion of sustainable and climate-resilient lifestyles have been identified and developed.
- The climate change adaptation component has been integrated into plans related to sustainable and healthy lifestyles.
- A catalogue of good examples of resilient lifestyles is available.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 17.6. PROTECTING AND PROMOTING EMPLOYMENT THROUGH ADAPTATION

DESCRIPTION OF THE LINE OF ACTION

Climate change adaptation actions can have two complementary effects on employment: the prevention of job losses by limiting the impacts of climate change, and the creation of new jobs resulting from the adaptation initiatives themselves.

Moreover, beyond their specific impact on a particular sector, many adaptation investments benefit the economy as a whole. For example, investments to make transport and energy infrastructure less vulnerable to climate extremes minimise disruptions and operational losses, with benefits for various sectors. In addition, some distribution companies, whose infrastructures extend into rural areas, can be agents of economic and employment dynamism in these areas. Similarly, adaptation in sectors such as agriculture, livestock, fisheries and forestry can help to combat depopulation and maintain the economic network of rural areas.

In order to properly focus this line of action, it will be necessary to study the effects of adaptation on employment, analysing the two key aspects mentioned above: the impact of climate change on employment (considering the sectoral and territorial dimensions) and the impact of adaptation policies and measures on employment.

On the basis of the above, support for vulnerable sectors or sectors with job creation potential may take the form of advisory actions, support for technology transfer, promotion of training, generation of curricular itineraries, financing for adaptation, etc.

Adaptation to climate change should also be included in the new activities being promoted under Just Transition Agreements, as it is a particularly interesting employment niche that will accelerate the ecological transition.

The creation of spaces for social deliberation on adaptation and employment (with the participation, where appropriate, of the business sector, social actors and administrations) will contribute to the correct orientation of this line of action.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITRAES (Ministry of Labour and Social Economy, in Spanish), Ministry of Education and Vocational Training, Ministry of Universities and MITERD, in collaboration with the autonomous communities.

COMPLIANCE INDICATOR

- A specific report is produced on climate change, adaptation and employment.
- Initiatives are developed to promote employment in the field of adaptation.
- Indicators are developed to monitor the evolution of employment in adaptation.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

European Social Fund and budgets of the organisations involved.

I.18. PEACE, SECURITY AND SOCIAL COHESION

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Peaceful, just and inclusive societies are a basic condition for achieving the Sustainable Development Goals (SDGs)¹⁵³ of the 2030 Agenda. One of the main strategies to prevent disputes from escalating into conflict is preventive diplomacy, which is based on detecting threats to peace and security in order to take early action and avoid future problems.

Climate change can increase instability and provoke social and political tensions and conflicts¹⁵⁴ in many different ways, including:

- Competition for access to increasingly scarce resources due to climate change.
- Serious impacts on people's assets or livelihoods, leading to situations of inequality and precariousness.
- Migratory movements as a result of the impacts of climate change, which may lead to new conflicts over living space and other resources.
- Climate change response measures themselves (adaptation and mitigation measures) can also lead to political and social conflicts by affecting the interests and expectations of human groups and individuals.

All these tensions and conflicts can occur at the international level, but also at the national level, generating new inequalities expressed in the form of inter-regional, social or political conflicts.

The challenge for Spain will be first to recognise the potential threat of climate change to peaceful coexistence and social cohesion, and then to anticipate the most appropriate responses. In this regard, the National Security Strategy,¹⁵⁵ approved in 2017, includes the effects of climate change as one of the most important challenges to be considered in terms of National Security. The aforementioned strategy identifies the reduction of greenhouse gas emissions, the fight against biodiversity loss, the review of energy supply and usage systems, the joint management of shared assets such as water or fishing resources, as well as a global pact between industrialised and emerging countries, as essential requirements for tackling the consequences of climate change.

153 - This issue is specifically developed in SDG 16.

154 - Paper from the High Representative and the European Commission to the European Council "Climate Change and International Security" https://www.consilium.europa.eu/media/30860/es_clim_change_low.pdf

155 - The National Security Strategy is the reference framework for Spain's national security policy.

The preservation, sustainable and fair use of water resources and the conservation of natural heritage have implications in the field of security. The loss of natural resources and ecosystem services can lead to massive population displacement, endangering migrants and putting stress on receiving areas. In this sense, it is necessary to further investigate the causes of migration, work on those causes and adapt to new realities, approaches and instruments, while promoting the positive aspects of legal migration in development processes.¹⁵⁶

From a climate change point of view, these challenges must be addressed from a resilience-building perspective, with a focus on reducing the vulnerability of people and communities.¹⁵⁷

LINE OF ACTION 18.1: PROMOTING PEACE AND SECURITY IN THE FACE OF THE IMPACTS OF CLIMATE CHANGE AT THE NATIONAL LEVEL

DESCRIPTION OF THE LINE OF ACTION

In Spain, the main security risks associated with climate change are those related to the uneven distribution, both geographically and seasonally, of water resources and the increased frequency and severity of droughts, floods and wildfires, as reflected in the National Security Strategy. In this sense, all the lines of action proposed in this plan are aimed at building a more resilient economy and society, and, as such, contribute to the prevention of conflicts associated with the impacts of climate change, especially those proposed for the aforementioned areas of work.

Beyond this consideration, and with a view to promoting peace and security in the face of the impacts of climate change at the national level, this line of action aims to:

- Prevent potential conflicts through early detection, integrating this analysis into climate change risk studies in order to recognise situations that may pose threats to peace, security and social cohesion. This approach will be particularly relevant in those areas of work that have been identified as the most sensitive.
- Strengthen social disclosure processes, citizen participation and conflict management processes as mechanisms to promote peace, security and social cohesion in the face of climate change. Spain must foster a culture

¹⁵⁶ - This is one of the areas of action and management of Spanish Cooperation identified in the Fifth Master Plan for Spanish Cooperation 2018/2021.

¹⁵⁷ - According to the vision reflected in the 2030 Agenda and taken up by the EU in its Global Strategy, the European Consensus on Development and the 2017 Joint Communication from the European Commission and the High Representative for Foreign Affairs to the European Parliament and the Council on a Strategic Approach to Resilience in the EU's external action.

of security and defence, supported by an inclusive education system that increases awareness of the main threats and challenges posed by climate change. Participatory adaptation planning and management also allows for better integration of the interests of different social actors, resulting in more inclusive, better understood, supported and legitimate public decisions, and should therefore be strengthened in those areas that pose the greatest challenges to peace and security.¹⁵⁸ In addition, where appropriate, conflict management mechanisms should be envisaged to address, through appropriate tools (including negotiations, mediation and, ultimately, arbitration), explicit disagreements that cannot be channelled through participatory mechanisms.

- Integrate knowledge on climate change risks into national security. In the framework of the National Security System, climate change adaptation must be integrated into the management of crises that may be affected by the threats and challenges that climate change poses to the peace and security of its citizens and territory, in order to provide effective and timely responses, including all phases from early warning to response. Threats posed by climate change to critical infrastructure and security organisations will be identified and specific adaptation programmes will be developed based on identified risks where appropriate.

RESPONSIBLE ENTITIES AND COLLABORATORS

Department of National Security (Presidency of the Government), MINISDEF, MIR and OECC.

COMPLIANCE INDICATOR

- The early detection and analysis of the potential conflicts that threaten security and social cohesion at national level are integrated into those areas considered to be particularly sensitive.
- The number and scope of social outreach, citizen participation and conflict management processes in those areas that pose the greatest challenges to peace and security are strengthened.
- Knowledge on climate change risks is integrated into the National Security System.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

¹⁵⁸ - Various lines of work oriented towards these objectives are already included in area of work 17, Education and Society, of this National Adaptation Plan, as well as in the proposals for the coordination and management of the plan.

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION 18.2: INTEGRATING CLIMATE CHANGE ADAPTATION INTO THE PREVENTION, MANAGEMENT AND RESOLUTION OF INTERNATIONAL CONFLICTS AND CRISES AND THE CONSTRUCTION OF A PEACEFUL, JUST AND INCLUSIVE GLOBAL SOCIETY

DESCRIPTION OF THE LINE OF ACTION

Preventing conflicts and crisis situations is more efficient and effective than managing and resolving crises once they have started. Building resilience from an integrated approach at the international level is fundamental for the prevention of conflict and crisis, contributing to the construction of a peaceful, just and inclusive global society.

Efforts within the UN to integrate climate change issues into security analyses and to address the climate change-security nexus, to ensure that the fight against climate change is also a factor in cooperation and conflict prevention, are particularly relevant. In a similar vein, it is worth highlighting "EU climate diplomacy", which currently addresses, among other aspects, the integration of the climate change dimension, including conflict prevention and international peacekeeping, into the EU's external action. Spanish diplomacy will, therefore, be monitoring and actively participating in these global and EU initiatives.

Spanish Cooperation has a fundamental role in the fulfilment of these objectives. According to the Spanish Action Plan for the Implementation of the 2030 Agenda, the Spanish Cooperation mission should focus on promoting the achievement of the SDGs and contributing, among others, to the fight against climate change. In the context of the 2030 Agenda and SDG 13 on Climate Action, Spanish Cooperation incorporates a global approach and a focus on reducing vulnerability to the effects of climate change into its strategic planning. The Master Plan for Spanish Cooperation 2018-2021 includes support to partner countries in the fulfilment of their Nationally Determined Contributions (NDC), which reflect their needs and priorities for action in terms of mitigation and adaptation to climate change. In addition, special attention is paid to the needs of the most vulnerable populations and ecosystems in order to prevent and mitigate disaster risk.

Spanish Cooperation sectoral action on climate change adaptation is developed through the Sectoral Action Plan (PAS) for Environment and Climate Change. In this context, this line of action proposes to maintain and develop the integration of adaptation to climate change in the strategies, plans and programmes of the Spanish Cooperation, maintaining the current focus on resilience and responding to the new international challenges posed by climate change.

Also, from a national security point of view, measures aimed at creating a more stable and secure international environment will need to take into account the assessment of the risks posed by climate change to national defence, both in terms of their operational requirements and their strategic orientation. Once the risks have been identified, preventive measures should be taken, taking into account all anticipatory, protective, preventive and intervention functions. In this regard, adaptation should be integrated into strategies, plans and programmes related to National Security and Defence, based on an assessment of vulnerabilities specific to these areas, and appropriate adaptation measures should be taken.

RESPONSIBLE ENTITIES AND COLLABORATORS

MINISDEF, MAEUEC (Ministry of Foreign Affairs, European Union and Cooperation, in Spanish) and AECID.

COMPLIANCE INDICATOR

- The MAEUEC actively participates in United Nations, EU and other relevant multilateral fora on the climate change-security nexus.
- Spanish Cooperation continues to integrate climate change adaptation into its strategies, plans and programmes, especially in the future Law on International Cooperation for Sustainable Development, the successive Master Plans and Humanitarian Action Strategies, and possible updates of the Sectoral Action Plan (PAS) for Environment and Climate Change, as well as in the Country Partnership Frameworks and other strategic planning instruments.
- Strategies, plans and programmes related to National Security and Defence that are oriented towards the prevention, management and resolution of international conflicts and crises, integrate adaptation to climate change, and relevant preventive measures are adopted for the adaptation of anticipatory, protective, preventive and intervention functions.

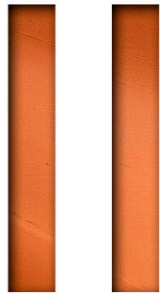
ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

ANNEXE



TRANSVERSAL LINES OF ACTION

ANNEXE 2. TRANSVERSAL LINES OF ACTION

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LINE OF ACTION T.1. TERRITORIAL VULNERABILITY

DESCRIPTION OF THE LINE OF ACTION

Climate change risks are not distributed homogeneously throughout the territory, so adaptive responses must integrate a spatial approach to identify the most vulnerable areas and adopt specific adaptation measures. In this sense, it is essential to incorporate the geographical perspective whenever possible in impact, vulnerability and adaptation assessments, as well as in the definition of regionalised responses.

Tackling adaptation to climate change from a territorial perspective also provides an opportunity to propose integrated strategies that simultaneously address different risks, in different areas and in a coherent manner with other territorial policies and measures, which favours the achievement of co-benefits and the creation of synergies.

Finally, it should be borne in mind that some territories have particular characteristics that determine vulnerability to climate change and the possible adaptive responses. In this regard, a series of geographical areas can be identified, such as islands, mountain areas and coastal or rural regions, which require specific analyses and specific responses adapted to their particularities.

The territorial approach can be integrated in various ways:

- Incorporation of analysis from a spatial perspective in the generation of knowledge on impacts, vulnerability and adaptation to climate change, when geographical variability and available data allow it.
- Generation of vulnerability and risk maps that favour regionalised planning of responses to climate change.
- Development of specific analyses and integrated adaptation response plans for geographical areas identified as particularly vulnerable to climate change.
- Support for the preparation of diagnoses and the definition of adaptation measures by organisations with a territorial base: local administrations (including county, island and provincial administrations) and regional administrations, as well as other organisations with a territorial base, such as river basin bodies, coastal districts, Regulatory Councils of Designations of Origin, etc.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD and other public administrations responsible for adaptation initiatives.

COMPLIANCE INDICATOR

- New impacts and risks analyses are developed from a territorial perspective.
- New territorially-based adaptation initiatives are developed.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION T.2. SOCIAL VULNERABILITY

DESCRIPTION OF THE LINE OF ACTION

Climate change affects different human groups unevenly. Lack of financial resources, poor physical conditions (such as poor health) or certain social disadvantages (for example, poor language proficiency) can multiply the vulnerability of certain social groups, which in turn can widen inequalities. Approaching adaptive responses without attention to these social differences can reinforce inequities in the distribution of climate change impacts. In this sense, the Paris Agreement, in its article 7.5, points out the need to integrate an approach to adaptation that considers the most vulnerable groups and communities.

In order to integrate this aspect effectively, two basic lines of work are proposed:

- **Assess social vulnerability:** The main factors of social vulnerability to climate change will be analysed in those areas where social factors may be most relevant when defining adaptive responses, and the main knowledge gaps will be identified. In practice, the breakdown of "climate risk" into three components (hazard, exposure and vulnerability), the disaggregation of vulnerability into "sensitivity" and "adaptive capacity", and its analysis taking into account social inequalities, facilitates the identification of those groups and communities with a higher level of risk to climate change impacts.
- **Develop socially just adaptive responses that are commensurate with levels of vulnerability:** It must be ensured that adaptation plans, policies and measures do not disadvantage certain social groups or increase existing social disparities. Efforts will be made to mobilise the most socially vulnerable collectives in order

to identify their specific vulnerabilities to climate change risks and to recognise them as key actors and implementers of adaptive responses.

Work will also be carried out on the development of qualitative and quantitative indicators of social vulnerability and adaptation to climate change in those areas where particularly vulnerable groups or communities have been identified.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, MIGU (Ministry of Equality, in Spanish), Ministry of Social Rights and 2030 Agenda and other public administrations responsible for adaptation initiatives, autonomous communities and local entities.

COMPLIANCE INDICATOR

- Information is available on exposure, sensitivity and adaptive capacity to climate change according to social variables in different areas of work.
- Actions are developed to promote the mobilisation of the most vulnerable groups.
- Specific indicators are available to understand social inequalities in the face of climate change and their evolution over time.
- The impact of PNACC actions is assessed from a demographic perspective.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION T.3. CROSS-BORDER EFFECTS

DESCRIPTION OF THE LINE OF ACTION

The effects of climate change outside of our borders become impacts in our country through various channels, including:¹⁵⁹

- **Trade flows:** Climate change impacts can be transmitted through global markets, affecting prices and supply chains.

¹⁵⁹ - Benzie, M., T. y otros (2017). Implications for the EU of cross-border climate change impacts, EU FP7 IMPRESSIONS Project Deliverable D3A.2.

- **Financial flows:** Climate change impacts can distort public and private capital flows.
- **Human flows:** Climate change impacts can trigger migrations and shifts in other types of human movements, such as tourism.
- **Geopolitical changes:** Climate change can impact on international relations, affecting humanitarian assistance, defence or cooperation policies.

This line of action is aimed at:

- Identifying chains of impacts associated with climate change that connect spaces beyond our borders with our country.
- Defining strategies and initiatives that can contribute to reducing the vulnerability of our country, while avoiding negative impacts on European and global vulnerability.

In the case of Spain, some potentially relevant effects to be analysed include the implications of climate change on the management of international river basins; risks to supply chains in the agri-food sector; cross-border migrations caused by adversities associated with climate change; changes in tourist flows due to changes in climate; changes in maritime transport routes due to the opening of new shipping routes; risks associated with investments in territories and sectors with a high vulnerability to climate change.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, MAEUEC, MISSM (Ministry of Inclusion, Social Security and Migration, in Spanish), MINCOTUR (Secretaries of State for Trade and Tourism), MINECO, MIGU and other public administrations responsible for adaptation initiatives.

COMPLIANCE INDICATOR

- There is an analysis of the main potential impacts in Spain arising from the effects of climate change abroad.
- Strategies to limit cross-border impacts are identified and supported.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION T.4. GENDER MAINSTREAMING

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DESCRIPTION OF THE LINE OF ACTION

The integration of gender mainstreaming in climate action has been reflected in various decisions under the UNFCCC and the Paris Agreement. In 2014, the Lima Work Programme on Gender and Climate Change was adopted, which recognises the importance of implementing gender-sensitive climate policies, both due to the particular vulnerability of women and girls and because of the importance of their role in the fight against climate change. Since then, the gender and climate agenda has been further strengthened with the adoption of a Gender and Climate Change Action Plan in 2017, which was revised and extended to 2025 at the 2019 Climate Summit (COP25).¹⁶⁰ Among UN policies for gender equality, the Beijing Platform for Action stands out, whose implementation contributes directly to the 2030 Agenda, and which has included a special area of concern on women and the environment since 1995.¹⁶¹

To effectively incorporate the gender approach in the framework of the PN-ACC:

- Sex-disaggregated data on climate change exposure, vulnerability and impacts will be collected and specific indicators will be developed to understand gender inequalities and to support gender-sensitive adaptation. This work should be based on analyses of aspects such as gender roles, opportunity (capacity) gaps and access to resources. On this basis, the planning, implementation, monitoring and evaluation of adaptation and specific measures and actions must integrate the gender dimension in a transversal manner.
- Gender differences in terms of access to information and training, risk perception, environmental behaviours and lifestyles will be considered, especially when developing adaptation measures associated with education and training, information and awareness raising, and the promotion of sustainable lifestyles.
- Women will be considered as active agents of change, by promoting their access to leadership positions, their resilience and decision-making capacities, their full, equal and meaningful participation in key decision-making forums on adaptation, and the consideration of their contributions to solutions that take into account the different gender gaps that still exist and the roles they play in society.

¹⁶⁰ - https://unfccc.int/sites/default/files/resource/cp2019_13a01S.pdf

¹⁶¹ - More information is available on progress made in the Review and Appraisal of the implementation of the Beijing Declaration and Platform for Action and the outcomes of the twenty-third special session of the General Assembly. Report of the Secretary-General <https://undocs.org/es/E/CN.6/2020/3>

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, MIGU and other public administrations responsible for adaptation initiatives.

COMPLIANCE INDICATOR

- Sex-disaggregated data on climate change exposure, vulnerability and impacts are available for different areas of work.
- Indicator systems have specific indicators to track gender inequalities and their evolution over time.
- Gender differences are integrated into adaptive responses, including technological, education and training, information and awareness raising responses, and the promotion of sustainable lifestyles.
- Concrete actions are developed to remove barriers to full, equal and meaningful participation in adaptation.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION T.5. PREVENTING MALADAPTATION AND ELIMINATING PERVERSE INCENTIVES

DESCRIPTION OF THE LINE OF ACTION

This line of action aims to avoid the development of climate change adaptation actions that contribute to an increase in greenhouse gas emissions, are disproportionate, cost inefficient, unsustainable or counter-productive in relation to other relevant long-term objectives. It also aims to avoid actions that disproportionately re-distribute the costs of adaptation to the most vulnerable or that define adaptation pathways that unfairly compromise options for future generations.

Initiatives to be developed under this line of action include the following:

- Development of tools for the initial testing of potential adaptation measures (checklists, etc.)
- Carrying out evaluations (ex-ante and ex-post) of adaptation measures to recognise in greater detail their implications in terms of associated emissions, social effects, implications for future generations, etc. In environmental

matters, environmental assessment, regulated by Law 21/2013 of 9 December, is considered a fundamental instrument for the detection and prevention of maladaptation.

- Incorporation, where appropriate, of criteria for the prevention of maladaptation in the assessment of projects submitted for public aid.
- Reconsideration of measures where there is evidence of maladaptation.
- Support for demonstrative and replicable projects, which provide solutions and good practices with a high level of follow-up and extensive dissemination, for the promotion of alternatives to maladaptive actions.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD and other public administrations responsible for adaptation initiatives.

COMPLIANCE INDICATOR

- Criteria for the prevention of maladaptation are in place.
- Pilot evaluations of adaptation measures are developed to assess their collateral effects and implications.
- Calls for adaptation aid incorporate mechanisms to prevent maladaptation.

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION T.6. COSTS AND BENEFITS OF ADAPTATION AND INACTION

DESCRIPTION OF THE LINE OF ACTION

The analysis of the economic, social and environmental costs and benefits of adaptive responses is a key element in decision-making, although it is very complex to calculate. In recent years, several methodologies have been developed (all very different from each other) that allow us to approach the estimation of these costs and benefits.

Costs and benefits are a crucial aspect that should be addressed in a transversal manner, not only by estimating them quantitatively (where possible and in a meaningful manner) and/or qualitatively, but also by trying to identify

the distribution of these costs and benefits across sectors and socio-economic groups, as well as their variation over time. These analyses should also be linked to the costs and benefits of mitigation and other socio-economic trends.

In order to progress in the estimation of the costs and benefits of adaptation, the following are proposed:

- Development of estimates of the costs and benefits of climate change impacts and adaptation measures in Spain for different scenarios and time periods, based on methodologies developed at international and European level.
- Application of analyses carried out prior to the approval of projects in specific fields of action.
- Consideration of the prerequisites for the implementation of the proposed adaptation measures, including the necessary budget, the need for policy changes or legislative developments, etc.
- Analysis of the direct and indirect effects of adaptation options in economic, environmental and social terms (including effects on climate change mitigation), with emphasis on potential co-benefits and possible unintended effects.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD and other public administrations responsible for adaptation initiatives.

COMPLIANCE INDICATOR

- Climate change adaptation and impact assessments estimate costs and benefits of the proposed adaptation actions.
- A cost-benefit analysis of adaptation measures to be developed within the framework of national funding instruments for measures is carried out, identifying prerequisites for their implementation and expected direct and indirect effects, and applying criteria to avoid maladaptation (see Line of Action T.5).

ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

LINE OF ACTION T.7. ORIENTATION TOWARDS ACTION

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DESCRIPTION OF THE LINE OF ACTION

All measures developed within the framework of this National Plan should help to "promote coordinated and coherent action to address the effects of climate change in Spain in order to avoid or reduce present and future damage from climate change and to build a more resilient economy and society". The specific objectives defined in each area of work constitute sectoral contributions to the general objective.

In order to achieve the objectives set out in the plan, it is essential that tangible actions are developed, with defined effects and considering the "adaptation cycle":

Generation of knowledge on the impacts and vulnerability to climate change and the identification of key future climate risks and adaptation options.

- Assessment and selection of adaptation options to be developed.
- Planning and implementation of concrete adaptation measures (combining structural and physical, institutional and social measures).
- Monitoring and evaluation in order to learn from experience and generate the necessary adjustments for continuous improvement throughout the process.

In this context, combinations of measures carried out in any phase of the "adaptation cycle" should be aligned with the defined objectives and strategically coordinated to achieve tangible results.

In addition, orientation towards action will require aligning the actions of the various actors contributing directly or indirectly to the objectives of the plan through coordination and actor mobilisation strategies, building on the envisaged governance structures and establishing strategic partnerships. It will also be necessary to mobilise the required resources to materialise the proposed measures and obtain tangible results, as well as to establish a system of impact and adaptation indicators to enable the monitoring of progress made towards the objectives of the plan.

In order to facilitate orientation towards adaptation, the plan envisages:

- Identification of knowledge needs for action.
- Sectoral adaptation planning.
- Establishment and the continued work of coordination, advisory and participation forums aimed at coordinating public policies on climate change.
- Development of information and monitoring tools, including a system of impact and adaptation indicators.
- Dissemination of practical cases of climate change adaptation.

RESPONSIBLE ENTITIES AND COLLABORATORS

MITERD, GTIA, FB and other relevant ministerial departments.

COMPLIANCE INDICATOR

- Established working forums (GTIA, Impacts, Risks and Adaptation Committee thematic seminars and thematic coordination groups) operate regularly.
- A system of impact and adaptation indicators is created.
- A collection of adaptation case studies is developed for dissemination.

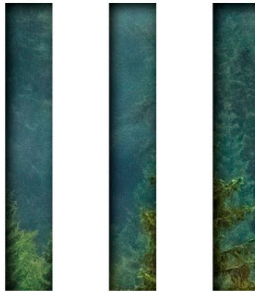
ARE REGULATORY INSTRUMENTS REQUIRED?

No

FUNDING

Regular budget of the organisations involved.

ANNEXE



IMPACT INDICATORS

ANNEXE 3.
IMPACT INDICATORS

The list of indicators in this annexe is intended as a tool that provides, when interpreted as a whole and not individually, a dynamic view of the effects of climate change and the progress achieved, if any, in terms of adaptation, facilitating the continuous improvement of policies and measures based on the analysis of the progress achieved and the identification of remaining challenges. They also aim to communicate the relevance of climate change adaptation.

Several aspects of the indicators (data availability, spatial and temporal resolution, uncertainties, etc.) require careful assessment. In this sense, this annexe should be understood as a first step in the creation of a library of indicators, which will need to be refined and improved as the level of knowledge progresses. For each of the indicators, the following information is provided:

- **Title**
- **Units:** Details on the units of measurement for the indicator.
- **Related areas of work:** Identifies the main areas of work related to each indicator.
- **Description:** Includes the rationale and a general explanation of the indicator.



INDICATOR 01. AVERAGE ANNUAL TEMPERATURE	
Units	Average surface temperature in degrees Celsius (°C).
Related areas of work	- Climate and climate scenarios.
DESCRIPTION	

The increase in average surface temperature is one of the most representative pieces of evidence of climate change. The evolution of the average annual temperature in Spain with respect to a reference period also makes it possible to observe the differences compared with the increase in the average temperature around the world.

INDICATOR 02. HEATWAVE DAYS

Units	Annual number of heatwave days.
Related areas of work	<ul style="list-style-type: none"> - Climate and climate scenarios. - Human health. - Water and water resources. - Forestry, desertification, hunting and inland fisheries. - Agriculture, livestock, fisheries, aquaculture and food.

DESCRIPTION

AEMET considers a "heatwave" to be an episode of at least three consecutive days in which at least 10% of the considered stations record maximum temperatures above the 95% percentile of their daily maximum temperature series for the months of July and August of the period 1971-2000. The number of heatwave days is relevant in many areas, particularly human health. There is a high correlation between maximum temperatures and mortality, as deaths increase significantly above a certain maximum temperature threshold.

INDICATOR 03. METEOROLOGICAL DROUGHT

Units	Standardized Precipitation Index (SPI): numerical value representing the number of standard deviations of precipitation over a particular accumulation period, with respect to the average, once the original distribution of precipitation has been transformed to a normal distribution.
Related areas of work	<ul style="list-style-type: none"> - Climate and climate scenarios. - Water and water resources. - Forestry, desertification, hunting and inland fisheries. - Agriculture, livestock, fisheries, aquaculture and food. - Energy. - Financial system and insurance activity.

DESCRIPTION

Through the use of the SPI index, it is possible to quantify and compare the intensities of precipitation deficits between areas with very different climates. The SPI index can also be integrated over a wide range of time scales, which means that it can be used as an indicator of different types of drought, both those of short duration, which produce effects mainly on the agricultural, forestry and livestock sectors, and to characterise climatic droughts of long duration, which lead to hydrological droughts.

INDICATOR 04. DEATHS DUE TO EXCESSIVE HEAT

Units	Annual number of deaths resulting from exposure to natural heat per year.
Related areas of work	- Human health.

DESCRIPTION

The specific mortality due to exposure to excessive natural heat corresponds to the number of people who die during the period of the National Plan of Preventive Actions on the Effects of Excessive Temperatures on Health due to exposure to excessive natural heat (coded in ICD-10 as X-30).

INDICATOR 05. AUTOCHTHONOUS CASES OF VECTOR-BORNE DISEASES

Units	Annual number of autochthonous cases of Dengue, Chikungunya virus disease and Zika virus disease.
Related areas of work	- Human health.

DESCRIPTION

Climate change could influence the frequency and distribution of some vector-borne diseases. Indeed, recent years have seen an increase in autochthonous cases and epidemic outbreaks of certain vector-borne diseases in Europe. The spread of the *Aedes albopictus* (tiger mosquito) vector in the Iberian Peninsula increases the likelihood of autochthonous transmission of diseases such as Dengue, Chikungunya virus disease and Zika virus disease

INDICATOR 06. WATER EXPLOITATION INDEX (WEI+)

Units	Percentage of the volume of water abstracted over the total average resource.
Related areas of work	- Water and water resources. - Agriculture, livestock, fisheries, aquaculture and food. - City, urban planning and building.

DESCRIPTION

The WEI+ water exploitation index establishes the ratio between the total freshwater abstracted for all human uses (including returns) and the resources available, considered in the long term. This indicator describes the pressure exerted by water abstraction on existing average resources. The index makes it possible to recognise whether water abstractions are sustainable in the medium and long term.

INDICATOR 07. NUMBER OF DECLARED PROLONGED DROUGHT SITUATIONS

Units	Number of declared situations of alert or emergency due to critical shortage in a hydrological year, by Territorial Drought Unit
Related areas of work	- Water and water resources. - Agriculture, livestock, fisheries, aquaculture and food. - Human health. - City, urban planning and building.

DESCRIPTION

Prolonged Drought indicators objectively assess whether or not the Territorial Drought Units defined in the Special Drought Plans indicate a situation of Prolonged Drought for the established regulatory purposes. This situation is evidence of a significant reduction of flows in water bodies, produced naturally as a result of decreased rainfall, regardless of existing water uses and demands.

INDICATOR 08. STATUS OF WATER BODIES

Units	Percentage of water bodies in each status category: very good, good, moderate, poor, bad.
Related areas of work	<ul style="list-style-type: none"> - Water and water resources. - Agriculture, livestock, fisheries, aquaculture and food. - Forestry, desertification, hunting and inland fisheries. - City, urban planning and building.

DESCRIPTION

The status of water bodies is the state of alteration that they present with respect to their natural conditions, considering both their chemical and ecological status. The first indicates the degree of compliance with environmental quality standards for a number of pollutants. The second expresses the quality of its aquatic ecosystems, considering their structure and functioning.

INDICATOR 09. ENDANGERED WILDLIFE SPECIES

Units	Number of species included in the Spanish Catalogue of Threatened Species where climate change is identified as a risk, pressure or threat factor.
Related areas of work	<ul style="list-style-type: none"> - Natural heritage, biodiversity and protected areas. - Forestry, desertification, hunting and inland fisheries. - Water and water resources. - Coasts and marine environment. - Tourism.

DESCRIPTION

Climate change can threaten the conservation of species and populations by altering their habitats and adding to other factors that compromise their survival. The Spanish Catalogue of Threatened Species lists threatened taxa or populations according to their level of risk. This indicator counts only those threatened species and populations where climate change is identified as a risk, pressure or threat factor.

INDICATOR 10. INVASIVE ALIEN SPECIES

Units	Number of species included in the Spanish Catalogue of Invasive Alien Species.
Related areas of work	<ul style="list-style-type: none"> - Human health. - Water and water resources. - Natural heritage, biodiversity and protected areas. - Forestry, desertification, hunting and inland fisheries. - Agriculture, livestock, fisheries, aquaculture and food. - Coasts and marine environment. - Tourism.

DESCRIPTION

Invasive alien species are those species that are introduced or become established in a natural or semi-natural ecosystem or habitat and are an agent of change and threat to native biological diversity, either through their invasive behaviour, or through the risk of genetic contamination. Climate change is altering the structure and composition of native communities and, as a consequence, the functioning of ecosystems, acting as a disturbance regime that increases the risk of biological invasions.

INDICATOR 11. . IMPACT OF CLIMATE CHANGE ON THE STATUS OF THE NATURA 2000 NETWORK

Units	Percentage of Natura 2000 sites where climate change is considered a pressure factor, by conservation status category (favourable/unfavourable).
Related areas of work	<ul style="list-style-type: none"> - Water and water resources. - Natural heritage, biodiversity and protected areas. - Forestry, desertification, hunting and inland fisheries. - Agriculture, livestock, fisheries, aquaculture and food. - Coasts and marine environment.

DESCRIPTION

The good conservation status of the Natura 2000 network and its natural resources is essential for adequate climate change mitigation and adaptation. The negative effects of climate change may cause habitats and species with a favourable conservation status to change to unfavourable or aggravate the status of habitats and species that already have an unfavourable assessment.

INDICATOR 12. VITALITY OF FORESTS

Units	Percentage of weakened trees (more than 25% defoliation) in the European Forest Damage Monitoring Network (Level I Network).
Related areas of work	- Forestry, desertification, hunting and inland fisheries.

DESCRIPTION

The ongoing and periodic evaluation of the points that make up the European Level I Network facilitates the recognition of the apparent state of health of trees and the health evolution of existing forest stands. The most significant parameter for assessment is defoliation, which is influenced by annual biotic or abiotic elements affecting forest processes.

INDICATOR 13. AREA AT RISK OF DESERTIFICATION

Units	Percentage of area in each desertification risk category: no risk, low, medium, high and very high.
Related areas of work	<ul style="list-style-type: none"> - Forestry, desertification, hunting and inland fisheries. - Water and water resources.

DESCRIPTION

The National Action Programme to Combat Desertification proposes a risk determination model based on the characterisation of the territory according to the intensity of certain desertification factors and processes (aridity index, erosion, recurrence of wildfires, overexploitation of aquifers). Climate change influences these factors and processes by driving changes in the defined risk categories.

INDICATOR 14. ORGANIC MATTER CONTENT IN AGRICULTURAL SOIL

Units	Percentage of soil organic carbon in agricultural land and grassland categories.
Related areas of work	- Agriculture, livestock, fisheries, aquaculture and food.

DESCRIPTION

The concentration of organic carbon in agricultural soils and its evolution is mainly due to climate, land cover and management practices. Increases in soil organic carbon are related to the conversion of crops to permanent forests or grasslands and soil conservation techniques, and reductions are related to climate change, as warmer and drier conditions favour the mineralisation of organic matter. Therefore, this indicator provides information on both the effects of climate change on agricultural land and its adaptive capacity, as increases in organic matter imply an improvement in colloidal structure and water retention capacity.

INDICATOR 15. WATER USE FOR IRRIGATED AGRICULTURE

Units	Total volume of water consumed for irrigated agriculture (hm ³), distribution by irrigation technique and water origin (%), and share of total abstractions (%).
Related areas of work	- Agriculture, livestock, fisheries, aquaculture and food. - Water and water resources.

DESCRIPTION

Spain is the leading country in terms of irrigated surface area in the European Union with more than 3.5 M ha, which represents 22% of the total crop area and the use of more than 60% of the water abstracted annually at national level. The necessary optimisation of water resource management in a context of climate change demands the simultaneous modernisation of irrigation systems and improved planning in both agriculture and water use. This indicator has therefore been developed as a tool for monitoring, knowledge generation and awareness raising in this respect.

INDICATOR 16. AREA OF IRRIGATED VINEYARDS

Units	Percentage of irrigated vineyards.
Related areas of work	- Agriculture, livestock, fisheries, aquaculture and food. - Water and water resources.

DESCRIPTION

The loss of climatic suitability for a large part of existing vine crops, together with the decrease in vineyard area, is leading to changes in vine production methods. As such, the percentage of irrigated area can be considered, in part, an indicator of the impact of climate change on a highly climate-dependent crop, as well as of its influence on the maintenance and improvement of water resources.

INDICATOR 17. AGRICULTURAL AREA INCLUDED IN COMMITMENTS TO ENHANCE CLIMATE CHANGE ADAPTATION

Units	Percentage of utilised agricultural land included in commitments to improve adaptation to climate change with respect to total utilised agricultural land.
Related areas of work	<ul style="list-style-type: none"> - Agriculture, livestock, fisheries, aquaculture and food. - Water and water resources. - Disaster risk reduction.

DESCRIPTION

The negative impact of climate change on the agricultural sector, and the negative impact of this sector on others, can be partly reduced through adaptation measures designed and tailored to every plot or sub-sector. Public action derived from instruments such as the Common Agricultural Policy will play a crucial role in facilitating and supporting farmers in overcoming barriers to adaptation and moving towards a more sustainable and resilient agriculture.

INDICATOR 18. ACTIVATION OF WARNINGS FOR COASTAL PHENOMENA

Units	Number of days with activated warning levels (yellow/orange/red) for coastal phenomena in each province.
Related areas of work	<ul style="list-style-type: none"> - Climate and climate scenarios. - Coasts and marine environment. - Agriculture, livestock, fisheries, aquaculture and food. - Industry and services. - Disaster risk reduction.

DESCRIPTION

Coastal phenomena, as considered within the National Plan for Adverse Phenomena (Meteoalerta), include wind in coastal sea areas (average wind strength according to the Beaufort scale) and wave height, a combination of wind sea (Douglas scale) and swell (in metres). For coastal warnings to be issued, exceeding the thresholds for average wind strength or wave height is sufficient, although both can be exceeded at the same time.

INDICATOR 19. ECONOMIC DAMAGE FROM COASTAL STORMS

Units	Damage assessment in coastal areas affected by storms and other catastrophic situations.
Related areas of work	<ul style="list-style-type: none"> - Coasts and marine environment. - Industry and services. - Disaster risk reduction. - Agriculture, livestock, fisheries, aquaculture and food. - Financial system and insurance activity.

DESCRIPTION

Climate change is modifying the occurrence of extreme weather events that cause emergency or catastrophic situations on the coast in terms of occurrence, intensity and periodicity. This indicator seeks to reflect the evolution of the economic damage caused by public and private goods, facilities and services, based on the declaration of the adoption of urgent measures to alleviate damage caused by storms and other catastrophic situations.

INDICATOR 20. SEASONAL DISTRIBUTION OF TOURISM

Units	Number of overnight stays during the summer months (June, July and August) over total number of overnight stays per year.
Related areas of work	<ul style="list-style-type: none"> - Water and water resources. - Industry and services. - Tourism.

DESCRIPTION

Overnight stay means each night that a traveller stays in a tourism establishment, including any unit offering hotel accommodation services (hotel, apartment hotel or aparthotel, motel, hostel, guest house, inn, bed and breakfast). June, July and August are the months with the highest number of overnight stays in Spain. The ratio of the number of overnight stays in the summer months to the total allows us to estimate the seasonal distribution of tourism.

INDICATOR 21. . AVERAGE LEVEL OF ENERGY EFFICIENCY IN BUILDINGS

Units	Percentage of residential (dwellings) and non-residential buildings in each energy rating letter.
Related areas of work	<ul style="list-style-type: none"> - City, urban planning and building. - Energy. - Human health.

DESCRIPTION

The energy rating scale measures the primary energy consumption deemed necessary to meet the energy demand of a building under normal usage conditions and the CO₂ emissions derived from it. In addition to the primary energy demand, the energy rating scale also influences the vulnerability of the population to extreme temperatures. This indicator operates on all residential and non-residential buildings (using different scales) with registered certificates and information based on their energy consumption by autonomous community and reflects the percentage of buildings in each energy efficiency letter over the total number of residential and non-residential buildings considered.

INDICATOR 22. HEAT ISLANDS IN URBAN AREAS

Units	Surface area and average intensity of urban heat islands.
Related areas of work	<ul style="list-style-type: none"> - Human health. - City, urban planning and building.

DESCRIPTION

The heat island effect is caused by the absorption of heat by buildings, asphalt and other materials in the urban environment. The heat accumulated during the day is released during the night, resulting in higher temperatures than those found in the unbuilt environment. This indicator records the surface area affected by the heat island effect and the intensity of the phenomenon.

**INDICATOR 23. WEATHER-RELATED INTERRUPTIONS
TO POWER SUPPLY**

Units	Annual number of outages in Spain for each settlement category (urban, semi-urban, concentrated rural and dispersed rural)..
Related areas of work	- Energy. - Disaster risk reduction.

DESCRIPTION

This indicator presents the number of electricity supply interruptions that occur annually in Spain due to floods, gales and increased demand associated with heat. Data are provided by differentiating between types of affected settlements: urban area (>10,000 inhabitants), semi-urban area (2,000 - 10,000 inhabitants), concentrated rural area (<2,000 inhabitants) and dispersed rural area (populations without a concentrated housing nucleus)

**INDICATOR 24. PRIMARY ENERGY CONSUMED
FROM RENEWABLE AND LOCAL SOURCES**

Units	Energy consumed per year (TJ/year) originating from renewable and local sources, by total generation source, and share of national energy consumption.
Related areas of work	- Energy

DESCRIPTION

This indicator measures the amount of primary energy of renewable and local origin consumed in Spain. Data are provided by differentiating between generation sources, including total renewable consumption. Sources considered include geothermal, solar thermal, heat pumps, primary solid biofuels, pellets and other plant waste, animal waste, the renewable fraction of industrial and municipal waste, and biogas.

**INDICATOR 25. AVERAGE COMPENSATION PAYMENT
BY EXTRAORDINARY RISK INSURANCE**

Units	Average compensation per claim at constant price, in euros.
Related areas of work	- Finance and insurance. - Disaster risk reduction.

DESCRIPTION

The Insurance Compensation Consortium (CCS) covers extraordinary damage caused by high winds, floods and sea storms. Compensations made by the CCS for these natural phenomena only cover insured property and therefore the total amount paid depends on the level of existing coverage. However, the evolution of average losses per claim can be seen as an indicator of the evolution of vulnerability over time.

**INDICATOR 26. AREA AFFECTED BY
LARGE FOREST WILDFIRES**

Units	Total area (ha) affected by large forest wildfires.
Related areas of work	<ul style="list-style-type: none"> - Forestry, desertification, hunting and inland fisheries. - Disaster risk reduction.

DESCRIPTION

Heat waves or groups of days with extreme temperatures are directly associated with the occurrence of large forest wildfires (those burning over an area larger than 500 ha), which explains the characteristic "zigzag" distribution associated with the most unfavourable meteorological periods. Higher temperatures and generally drier conditions caused by climate change exacerbate the wildfire regime, facilitating the spread of wildfires and making them more difficult to extinguish, resulting in a larger affected area for each wildfire considered to be of large dimensions.

**INDICATOR 27. FATALITIES DUE TO FOREST WILDFIRE,
FLOODS AND COASTAL STORMS**

Units	Number of deaths due to forest wildfires, floods and coastal storms per year.
Related areas of work	<ul style="list-style-type: none"> - Human health. - Water and water resources. - Forestry, desertification, hunting and inland fisheries. - Coasts and marine environment. - Mobility and transport. - Disaster risk reduction. - Education and society.

DESCRIPTION

Climate change is expected to increase the risk associated with forest wildfires, floods and maritime storms by influencing their frequency and intensity. In Spain, in the context of natural phenomena, meteorological phenomena cause the most human losses, far more than any other natural phenomena.

INDICATOR 28. PEOPLE DISPLACED DUE TO CLIMATE EVENTS

Units	Number of people internally displaced due to climate events.
Related areas of work	<ul style="list-style-type: none"> - Human health. - Disaster risk reduction. - Education and society.

DESCRIPTION

Internally displaced persons are persons or groups of persons who have been forced or obliged to flee or abandon their homes or places of habitual residence as a result of various situations including natural disasters, and who have not crossed an internationally recognised state border. This indicator captures the number of people who have been displaced each year in Spain due to climate-related events.

**INDICATOR 29. SOCIETY'S ATTITUDE
TO CLIMATE CHANGE ADAPTATION**

Units	Percentage of people interviewed showing a positive attitude towards adaptation.
Related areas of work	Education and society.

DESCRIPTION

The more or less positive attitude of the public towards adaptation to climate change is a factor that can condition the success of adaptation policies and measures. Various opinion polls have posed this question to representative samples of the Spanish population, providing information on the opinion on the issue and its evolution.

**INDICATOR 30. ACTIVE SEARCH FOR
INFORMATION ON ADAPTATION**

Units	Evolution of searches about adaptation on the Google search engine (Google Trends tool) and annual number of visits to the Climate Change Adaptation Platform, AdapteCCa (Google Analytics tool).
Related areas of work	Education and society.

DESCRIPTION

The active search for information on the internet is considered a good indicator of the level of relevance that a society attaches to a certain topic. This indicator uses two complementary data: a) the evolution of searches about climate change adaptation on the most popular search engine in Spain (Google), and b) the evolution of visits to the AdapteCCa platform, which provides information on the active search for more technical information.

INDEX OF ACRONYMS

AdapteCCa: Climate Change Adaptation Platform

AEMET: Spanish Meteorological Agency (MITERD)

AESAN: Spanish Agency for Food Safety and Nutrition (Ministry of Consumer Affairs)

APA: Portuguese Environment Agency

AR6: IPCC Sixth Assessment Report

AUE: Spanish Urban Agenda

BOE: Official State Gazette

CAP: Common Agricultural Policy

CBD: Convention on Biological Diversity

CCPCC: Climate Change Policy Coordination Commission

CCS: Insurance Compensation Consortium (MINECO)

CCyTE Bill: Climate Change and Energy Transition Bill

CEAM: Mediterranean Center for Environmental Studies

CEDEX: Centre for Public Works Studies and Experimentation

CENEAM: National Centre for Environmental Studies

CFP: Common Fisheries Policy

CIRA: Impacts, Risks and Adaptation Committee (working group of the Committee of Experts on Climate Change and the Energy Transition)

CNCP: National Catalogue of Professional Qualifications

COVID-19: Coronavirus disease. Disease caused by the SARS-CoV-2 coronavirus.

CSIC: Superior Council for Scientific Research

DG: Directorate General

DGPCE: Directorate General for Civil Protection and Emergencies (Ministry of the Interior)

DPMT: Maritime-Terrestrial Public Domain

EC: European Commission

ECV: Essential Climate Variables

EEA: European Environment Agency

EIONET: European Environment Information and Observation Network

ELP: Long-term strategy for a modern, competitive and climate-neutral economy by 2050

ENESA: State Entity for Agricultural Insurance (MAPA)

ERESEE: Long-term strategy for the renovation of building stock

ESF+: European Social Fund +

EU: European Union

FB: Fundación Biodiversidad (Biodiversity Foundation - MITERD)

FEMP: Spanish Federation of Municipalities and Provinces

GCOS: Global Climate Observing System

GTIA: Impacts and Adaptation Working Group (of the Climate Change Policy Coordination Commission - CCPCC)

IDAE: Institute for Energy Diversification and Saving (MITERD)

IEO: Spanish Oceanography Institute

IM: Women's Institute

INAP: National Institute of Public Administration (MPTFP)

INSST: National Institute for Occupational Safety and Health (MITRAES)

IPBES: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

IPCC: Intergovernmental Panel on Climate Change

ISCIH: Carlos III Health Institute

L.A.: Line of Action

T Line of Action: Transversal Line of Action

MAEUEC: Ministry of Foreign Affairs, European Union and Cooperation

MAPA: Ministry of Agriculture, Fisheries and Food

MCD: Ministry of Culture and Sport

MH: Ministry of Finance

MIGU: Ministry of Equality

MINCOTUR: Ministry of Industry, Trade and Tourism

MINECO: Ministry of Economic Affairs

and Digital Transformation

MINISDEF: Ministry of Defence

MIR: Ministry of the Interior

MISSM: Ministry of Inclusion, Social Security and Migration

MITERD: Ministry for the Ecological Transition and the Demographic Challenge

MITMA: Ministry of Transport, Mobility and the Urban Agenda

MITRAES: Ministry of Labour and Social Economy

MPTFP: Ministry of Territorial Policy and Public Function

NÁYADE: Bathing Water Quality Information System

NbS: Nature-based solutions

OAPN: Autonomous Agency for National Parks (MITERD)

OECC: Spanish Climate Change Office (MITERD)

OPPE: State Ports Public Agency (MITMA)

PES: Drought Management Plans

PGRI: Flood Risk Management Plan

PHC: River Basin Management Plan

PIMA: Plan to Support the Environment

PNACC: National Climate Change Adaptation Plan

PNACC-1: First National Climate Change

Adaptation Plan

PNACC-2: Second National Climate Change Adaptation Plan

PNIEC: National Integrated Energy and Climate Plan 2021-2030

RCP: Representative Concentration Pathways (for emissions)

SDG: Sustainable Development Goal

SEGITTUR: State Trading Company for the Management of Innovation and Tourist Technologies (MINCOTUR)

SG: Secretary General

SINAC: Drinking Water Quality Information System

SME: Small and medium-sized enterprises

UNCCD: United Nations Convention to Combat Desertification

UNFCCC: United Nations Framework Convention on Climate Change

WMO: World Meteorological Organization

GLOSSARY¹⁶²

Adaptation

Process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm from climate change or exploit beneficial opportunities.

Adaptive capacity

The ability of systems, institutions and humans to adjust to potential damage, to take advantage of opportunities, or to respond to the consequences.

Climate scenario

A plausible and generally simplified description of the future climate based on a series of consistent and mutually coherent assumptions.

Emissions scenario

A plausible representation of the future development of emissions of substances that are potentially radiatively active (e.g., greenhouse gases, aerosols) based on a coherent set of assumptions about driving forces (such as demographic and socio-economic development and technological change) and their key relationships. Concentration scenarios, derived from emission scenarios, are used as input to a climate model to obtain climate projections.

¹⁶² - - The definitions are mainly based on those set out in the glossary of the Report of Working Group II of the IPCC Fifth Assessment Report.

Exposure

The presence of people, livelihoods, species or ecosystems, environmental functions and services, and economic, social, or cultural assets in places and settings that could be adversely affected.

Extreme events

An extreme weather event is an event that is rare at a particular place and time of year. When a pattern of extreme weather persists for some time (such as for a season), it may be classed as an extreme climate event, especially if it yields an average or total that is itself extreme (e.g., drought or heavy rainfall over a season).

Impacts

Effects of extreme weather, climate events and climate change on natural and human systems. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economic, social and cultural assets, services (including environmental services) and infrastructures due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also referred to as consequences and outcomes. The impacts of climate change on geophysical systems, including floods, droughts and sea level rise, are a subset of impacts called physical impacts.

IPCC

The Intergovernmental Panel on Climate Change (IPCC) is a scientific organisation created in 1988 by the World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP). It was established to provide objective, clear, balanced and neutral information on the state of knowledge on climate change to policy makers and other stakeholders.

Maladaptation

Maladaptive actions are those that may lead to increases in the risk of negative climate-related effects, increased vulnerability or loss of well-being, now or in the future. Examples would be measures that increase exposure to climate risks (e.g. promotion of economic development in high-risk locations), measures that increase climate risks (e.g. increased greenhouse gas emissions), measures that increase environmental, social or economic vulnerability (e.g. displacement of flood risk downstream) or measures that reduce incentives for adaptation.

Mitigation

Human intervention to reduce the sources or enhance the sinks of greenhouse gases.

Nature-based solutions¹⁶³

Solutions to societal challenges that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience.

Projection

The potential future evolution of a variable, or a set of variables, often obtained with the help of models. In contrast to predictions, projections are conditional on a number of assumptions (e.g. regarding the socio-economic future or technological development).

Progressive adaptation

An adaptation initiative with the central objective of maintaining the essence and integrity of a system or process at a given scale.

Radiative forcing

Change in the balance between the amount of energy entering and leaving the Earth's atmosphere. A positive forcing tends to warm the planet, while a negative forcing tends to

163 - Source: PNACC-1

cool it. The magnitude of radiative forcing is usually measured in watts per square metre (W/m²).

Resilience

The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation

Risk

Potential consequences when something that is considered valuable is at stake and the outcome is uncertain. Risk is often expressed as the probability of occurrence of a hazardous event or the product of trends in the impacts should those events or trends come to pass.

Sensitivity

The degree to which a system or species is affected, positively or negatively, by climate variability or change. The effects can be direct (e.g. a change in average temperature or the intervals between temperature fluctuations can lead to a variation in crop yields) or indirect (sea level rise can lead to an increase in the frequency of coastal flooding, which in turn will cause damage along the coastline).

Transformational adaptation

Adaptation that changes the fundamental attributes of a system in response to the climate and its impacts.

Uncertainty¹⁶⁴

Describes the quality of our knowledge associated with a risk, or a value (e.g. the future state of the climate system). Uncertainty can result from lack of information or from disagreement about what is known or even knowable. It may have many types of sources, from quantifiable errors in the data to ambiguously defined concepts or terminology, or

uncertain projections of human behaviour. Uncertainty can therefore be represented by quantitative measures (e.g. a range of values calculated by various models) or by qualitative statements (e.g., reflecting the judgment of a team of experts).

Vulnerability

The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

164 - Source: "OPPLA - EU Repository of Nature-Based Solutions" 2019.



NATIONAL CLIMATE CHANGE ADAPTATION PLAN

2021 · 2030

RETURN TO
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