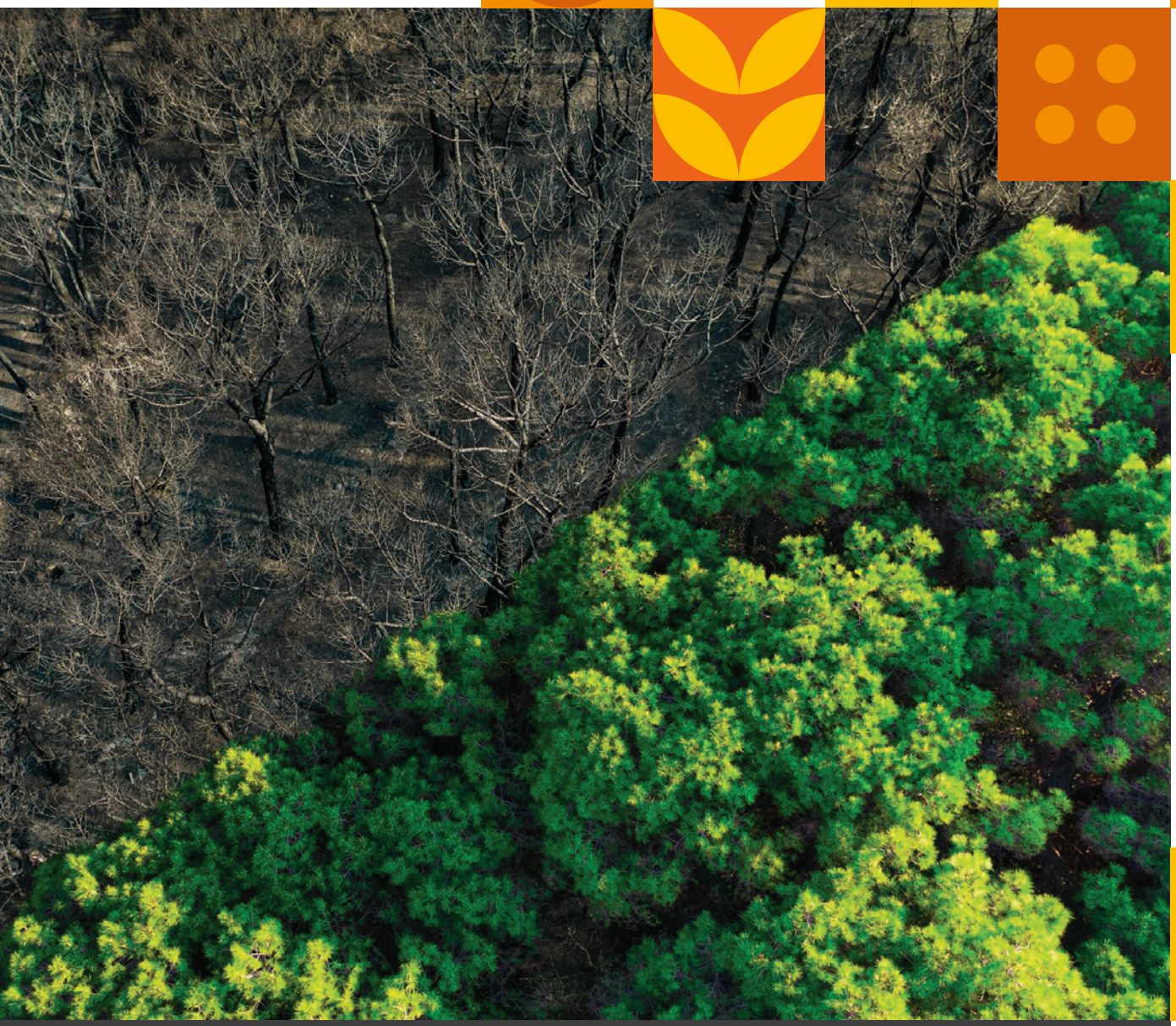

Physical threats of Climate Change and its social impact in Spain

Highlighting the effects on well-being and quality of life

pwc

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Cruz Roja

Fundación Naturgy

About this report

Climate change is a reality that is manifesting itself through various effects, such as an increase in extreme weather events (heatwaves, droughts, floods), the melting of the polar ice caps, and changes in ecosystems. These phenomena are having wide-ranging impacts on biodiversity, food security, water resources, the economy, and human health, among others.

This report addresses the urgent need to highlight the direct impact of climate change on the well-being and quality of life of Spanish society. Although traditionally considered an environmental issue, climate change goes far beyond this view, significantly and multidimensionally affecting people's lives. Its progression exacerbates pre-existing challenges and introduces new threats that demand strategic responses at both global and national levels.

Given the evidence of recent climate-related events in Spain—such as the unexpected DANA[1] that struck various regions, particularly the Valencian Community in October 2024, the DANA in the Balearic Islands in August 2024, as well as an unusually warm winter in both the Mediterranean region and the Canary Islands, and a very warm winter throughout the rest of Spain—concerns are growing across public and private sector entities regarding the impacts of these physical threats on society.

These concerns stem from existing information about the consequences of such events: limited access to water resources, growing inequalities due to the unequal geographical distribution of climate events, increased mortality from heat exposure during working hours, and heightened vulnerability of certain groups (increased isolation, greater need for resources or assistance to cope with these threats, etc.).

In this context, Fundación Naturgy, Cruz Roja, and Fundación PwC have jointly taken the initiative to produce this report, which aims to analyze the potential impacts of climate-related physical threats on key variables that define Spanish society. The analysis brings together a comprehensive body of physical and scientific evidence on climate change, along with future projections, to demonstrate its likely significant impact on our surroundings.

Globally, numerous studies have focused on the economic impacts of climate change. Increasingly, research is also being dedicated to its effects on other critical aspects such as human health, biodiversity, migration caused by natural disasters, and food availability.

At a regional level, this report includes data showing that climate-related migration could lead to the arrival of an estimated 4.4 million working-age climate migrants in Spain during the 21st century. Another significant figure is the projected 31.2% increase in the number of people facing water scarcity by 2050. Additionally, projections suggest that by the year 2100, over 200,000 deaths in Spain could be attributed to climate change. From an economic perspective, future heatwaves could reduce Spain's GDP by between 2% and 3% in the years 2040 and 2050, respectively.

This report focuses on analyzing and understanding the impacts of climate-related physical threats on Spanish society. Its aim is to shed light on how these threats affect the population's well-being and quality of life, as well as to explore their long-term social repercussions.

[1] DANA responds to "Isolated Depression at High Levels" and its equivalent to a Cut-Off Low (COL) event.

To carry out this analysis, four major areas that shape society have been defined: demographics, inequality, health, and economy, specifically within the Spanish context. Fifteen key variables have been identified to characterize and quantify the state of Spanish society in each of these areas. In parallel, and in order to isolate the effect of climate change on these variables, public data and information from authoritative sources have been collected to demonstrate and quantify the impact of physical climate threats.

Using this information, the report analyzes and compares the parallels and interconnections between the impacts of climate change and the future development of the selected social variables. The aim is to determine how these four pillars of societal well-being will be affected in the long term.

Accordingly, the methodology used in this report is based on a thorough literature review, with the following objectives: (i) to characterize the physical threats associated with climate change in Spain; (ii) to define Spanish society based on four key areas and their corresponding social variables; (iii) to identify and understand documented social impacts and evaluate their effects; and (iv) to categorize and prioritize the social variables most affected by climate change.

It is important to note that in this process, efforts have been made to isolate the effects of climate-related physical threats on the selected social variables. In other words, this analysis focuses solely on the direct consequences of climate change, excluding the influence of other events or phenomena, such as mitigation measures, armed conflicts, or economic crises, which could also affect the same variables.

This report has been prepared solely for informational and educational purposes. The data and conclusions included are the result of a rigorous review of technical and scientific literature, compiling relevant information on climate risks and their social impacts. However, the report does not intend to offer absolute or definitive predictions.

The content should not be interpreted as a conclusive statement on the effects of climate change. Instead, it is intended as a self-explanatory and informative document for the public, supported by various reliable sources.

Lastly, given the complex and evolving nature of climate change and its evidence, it is essential to acknowledge the inherent uncertainty in the data and analysis, especially regarding the future behavior of climate variables and the realization of projected scenarios.

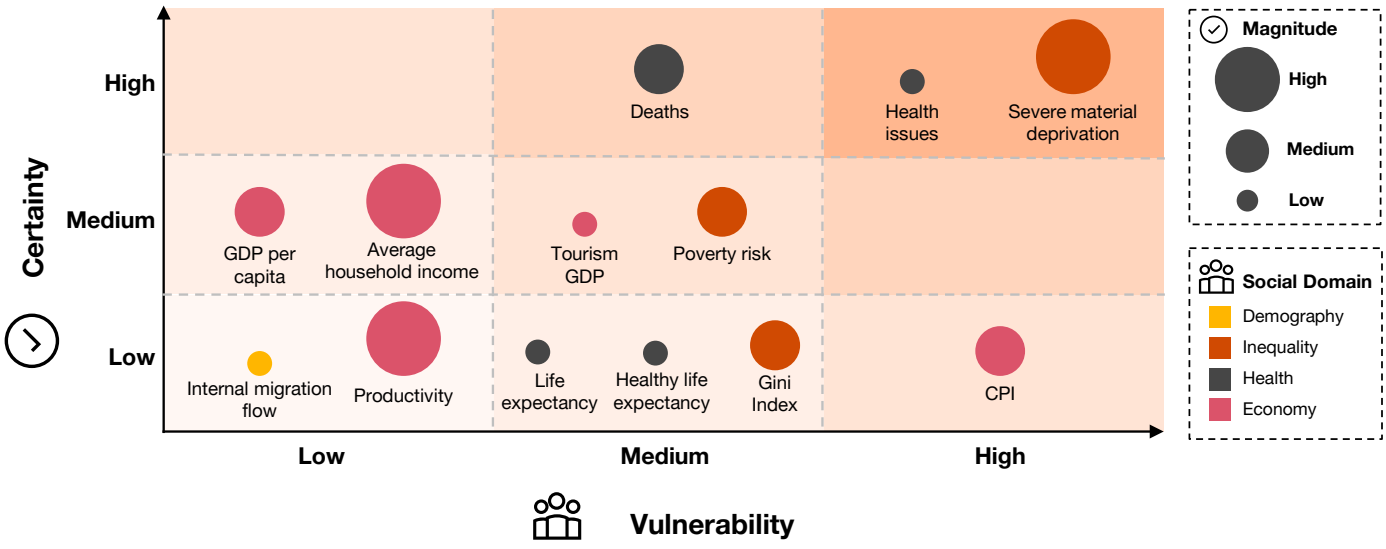
In this regard, everything expressed in this report reflects exclusively the views of PwC, which is solely responsible for the methodology and execution of the study, the topics selected, and the drafting of the document, not those of the collaborators or interviewees.

> ***"Climate change will affect the quality of life of Spanish society, exacerbating existing problems and particularly impacting vulnerable social groups with less capacity to adaptn."***

Main conclusions of the report

"Climate change will continue to impact Spanish society in the coming years, threatening aspects such as demography, equality, health, the economy, and ultimately, the well-being of the population."

Figure **Categorization matrix of negative social impacts derived from climate change**



Source: PwC Analysis.

"Climate change impacts demography through population movements caused by extreme weather events or long-term environmental changes."

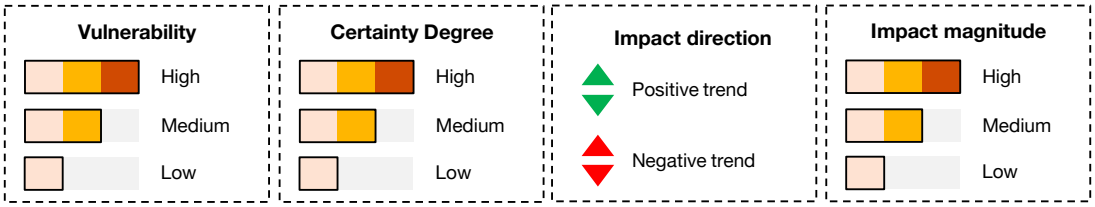
Demography

- The evolution of the population and the working-age population are two critical variables in Spain's current demographic landscape. The slowdown in population growth, combined with aging, negatively affects the share of working-age individuals, placing these variables at high and medium vulnerability, respectively. However, in a unique way, these variables could benefit from climate change.
- It is estimated that during the 21st century, 4.4 million climate migrants of working age will arrive in Spain. This could help counteract the decline in the working-age population, enhancing the sustainability of the social welfare system and invigorating the labor market.
- Nonetheless, inter-regional migrations, which have evolved positively due to reduced flows in recent years, may be negatively impacted, as they are expected to rise due to extreme weather events and rising temperatures in certain regions. In particular, it is estimated that more than 17,000 internal displacements per year could result from wildfires. These population movements might lead to some instability in population distribution, although the overall impact is expected to be relatively low.
- In conclusion, climate change could help mitigate some of the current demographic risks in Spain, such as population aging and workforce reduction, but it will not provide a complete long-term solution.

Figure **Results of the analysis of the direction and magnitude of the impacts of climate change on Spanish demographics**

Demography

Variables	Vulnerability	Degree of certainty of the impact	Impact direction	Impact magnitude	Impact projection
Population evolution			▲		**4,4 million working age climate migrants during the 21st century**
% Population aged 15-64 years			▲		
Internal migration flow			▲		**17,392 internally displaced persons annually due to fires**



Source: PwC Analysis.

Inequality

- In terms of inequality, in 2023, the severe material deprivation rate in Spain reached its peak, affecting 8.9% of the population. This positions it as a highly vulnerable variable, exposed to greater risk from negative external shocks. The analysis indicates that climate change will have a significant and highly probable impact on this variable, making it one of the most affected.
- In particular, severe material deprivation will be exacerbated by several climate-related factors. Water scarcity, expected to increase by more than one month per year, will affect an additional 31.2% of those already living in deprivation. Agriculture will also be significantly impacted, affecting food prices. For example, maize yields could drop by more than 80% by 2050 under a 3°C warming scenario, posing a threat to food security. Additionally, the increase in cooling degree days—projected to rise between 15% and 37% under the RCP8.5 scenario by 2050—will drive up energy costs for cooling, disproportionately affecting the most disadvantaged households.
- On the other hand, the at-risk-of-poverty rate and the Gini Index are in a medium vulnerability situation. While the impact of climate change on the Gini Index is uncertain, the certainty level is medium in the case of the at-risk-of-poverty rate. It is estimated that this population could increase by 1.3% (in the SSP2-RCP4.5 scenario) to 2.8% (in the SSP5-RCP8.5 scenario) by 2050.
- These combined factors are likely to worsen access to basic resources, deepening material deprivation and widening social inequalities in Spain. The scale and certainty of these impacts highlight the urgent need to develop policies and adaptation measures to protect the most vulnerable segments of society from the adverse effects of climate change.

> ***"Climate change affects inequality by increasing poverty, reducing access to energy services, and diminishing both food and water resources."***

Figure **Results of the analysis of the direction and magnitude of the impacts of climate change on inequality**

Inequality

Variables	Vulnerability	Degree of certainty of the impact	Impact direction	Impact magnitude	Impact projection
Poverty risk rate			▲		Increase in the population at risk of poverty by between 1.3% (SSP2-RCP4.5) and 2.8% (SSP5-RCP8.5) by 2050
Gini Index			▼		
Rate of severe material deprivation			▲		Increase in wáter scarcity by more than a month per year and affecting an additional 31.2% of people living in this situation Reduction of over 80% in corn yield (3ºC, 2050) Increase in cooling degree days by between 15% and 37% (RCP8.5, 2050)

Vulnerability
High
Medium
Low

Certainty Degree
High
Medium
Low

Impact direction
Positive trend
Negative trend

Impact magnitude
High
Medium
Low

Source: PwC Analysis.

Health

- The health sector, along with inequality, is under particular scrutiny, as all analyzed variables are in a medium or high vulnerability situation. This is due to a relative increase in health problems and mortality, coupled with a decrease in healthy life years.
- The variables in this area are closely interrelated, as health conditions and age of death are key determinants of life expectancy. Although health issues are classified as highly vulnerable and the impact of climate change is highly certain, the expected magnitude of this impact is relatively low. For example, by 2041–2060, more than 440,000 people in Spain are expected to become sensitized to ragweed pollen.
- Conversely, by the year 2100, more than 200,000 deaths related to climate change are expected in Spain. This figure, along with the high certainty of impact, underscores the severity of the situation.
- In conclusion, climate change represents a significant challenge for public health in Spain, increasing the population's vulnerability to various health conditions and raising mortality rates. However, the magnitude of these impacts is not expected to be severe enough to drastically reduce life expectancy.

> ***"Climate change affects human health by increasing mortality, the incidence of climate-sensitive diseases, the spread of vector, water, and food-borne diseases, and exacerbating allergies."***

Figure **Results of the analysis of the direction and magnitude of the impacts of climate change on health**

Health

Variables	Vulnerability	Degree of certainty of the impact	Impact direction	Impact magnitude	Impact projection
Life expectancy at birth			▼		**+200,000 deaths due to climate change by 2100**
Healthy life expectancy at birth			▼		
People with health issues			▲		**+440,000 people sensitized to ragweed pollen (2041-2060)**
Deaths (per 100,000 inhab.)			▲		

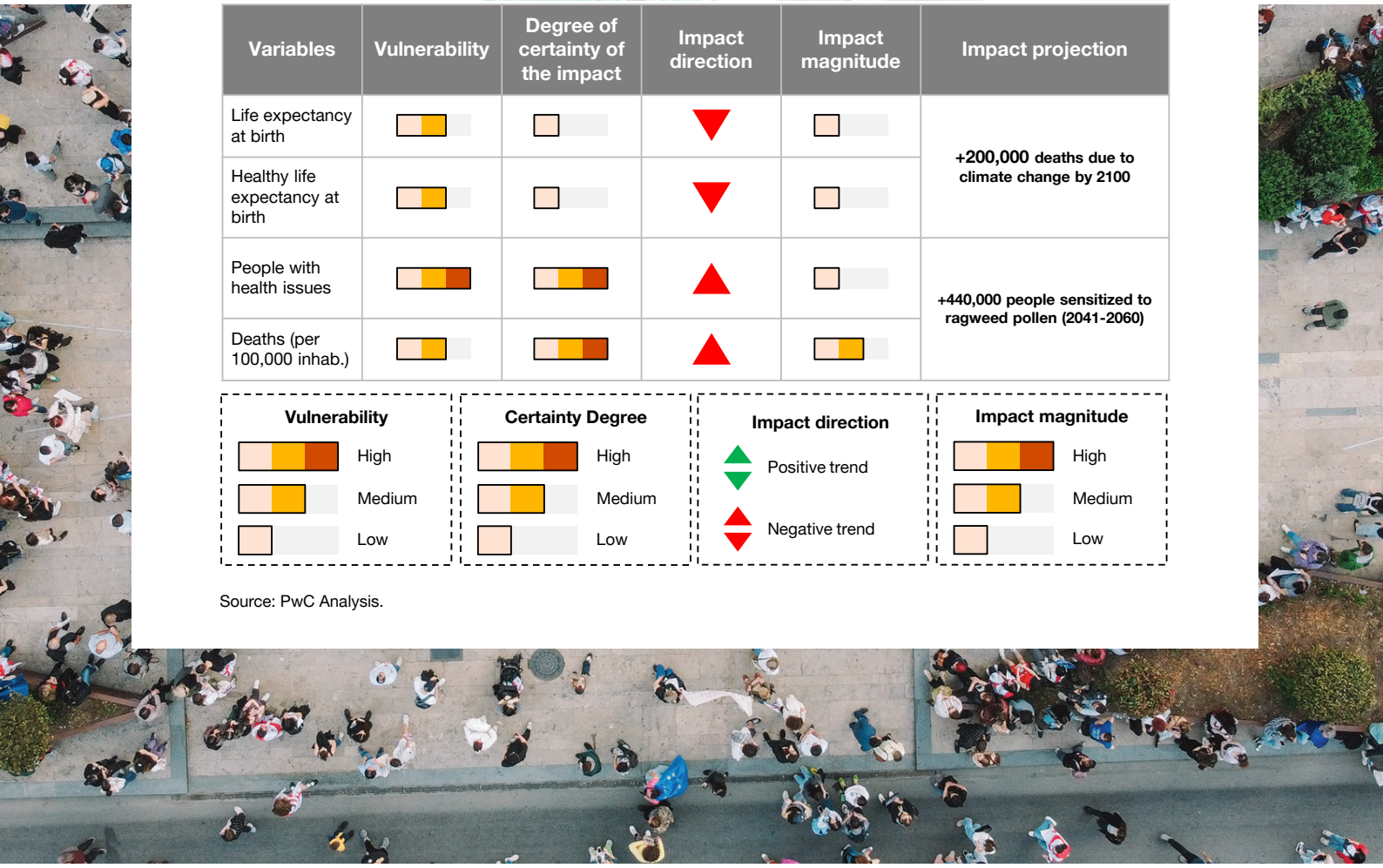
Vulnerability
High
Medium
Low

Certainty Degree
High
Medium
Low

Impact direction
Positive trend
Negative trend

Impact magnitude
High
Medium
Low

Source: PwC Analysis.



Economy

- The economy is one of the areas that has so far shown a lower vulnerability, as, except for the CPI, all variables have evolved positively in recent years. However, it is also one of the areas where the greatest impacts from climate change are expected.
- Household income and the CPI are the economic variables that require the most attention. Household income should be monitored due to its high impact magnitude and medium level of certainty, while the CPI is concerning due to its medium magnitude and high vulnerability level. It is estimated that by 2035, food inflation will increase by between 1.79 and 3.78 percentage points per year, and by 2049, per capita income in Spain could decrease by 17.8% due to climate change.
- Additionally, although with a lower level of concern, are per capita GDP, productivity, and tourism GDP. Per capita GDP is expected to decrease by around 2% by 2040 and 3% by 2050 due to heatwaves. Tourism GDP will also be affected, with a reduction in tourism demand estimated between 0.31% and 3.14% by 2100. Lastly, a productivity decline of between 3% and 8% is estimated for 2080.
- These combined factors indicate that although the Spanish economy has shown resilience, the impacts of climate change could pose significant risks. Proper management of inflation, income, and other economic indicators will be essential to sustaining the country's economic and social well-being in the face of future climate challenges.

> ***"Climate change is altering the economic landscape, affecting various productive sectors and manifesting through diverse macroeconomic and sector-specific variables."***

> ***"It is estimated that climate change will lead to a 17.8% reduction in per capita income in Spain by 2049, with Extremadura, Andalucía, and the Community of Madrid being the most affected regions."***

Figure **Result of the analysis of the direction and magnitude of the impacts of climate change on the economy**

Economy

Variables	Vulnerability	Degree of certainty of the impact	Impact direction	Impact magnitude	Impact projection
GDP per capita			▼		**Reduction of between 2% (2040) and 3% (2050) of GDP due to heatwaves**
Average household income			▼		**Reduction in per capita income by 17.8% by 2049**
Productivity			▼		**Reduction of between 3% and 8% in productivity by 2080**
CPI			▲		**Increase in food inflation by between 1.79 and 3.78 percentage points per year by 2035**
Tourism GDP			▼		**Reduction in tourism demand by between 0.31% and 3.14% by 2100**

Vulnerability
High
Medium
Low

Certainty Degree
High
Medium
Low

Impact direction
Positive trend
Negative trend

Impact magnitude
High
Medium
Low

Source: PwC Analysis.