

Changes in the mediterranean region in the last century

Global environmental change in the Mediterranean region manifests itself mainly in three types of impacts: climate change, with an **increase in temperature and a decrease in precipitation**; imbalance of biogeochemical cycles, with an increase in greenhouse gases and eutrophication of water; and loss of biodiversity. At landscape level, there has been a rural exodus that has caused a **very significant decrease in the area devoted to crops and an increase in the area of forests**. This rural depopulation has led to the **abandonment of traditional farms, and the increasing concentration of intensive agriculture and livestock in the plains**.

■ Global environmental change in the Mediterranean region

Europe, and in particular the Mediterranean region, **is one of the places in the world where global environmental change is occurring with the greatest intensity**. This environmental change manifests, among others, in three main impacts:

(a) Climate change. Europe is warming faster than the global average. It is especially true in the Mediterranean region, where **climate change has extreme consequences**: the period of extreme heat increases, rainfall and river flow are reduced, and this increases the risk of droughts and, with it, the risk of forest fires. That is why **all southern European countries have declared a state of climate emergency**. In Spain, the outlook is even worse: **the average Spanish temperature has increased by more than 0.5°C every decade since the beginning of the 20th century** (Gómez-Cantero 2015). Added to this is a decrease in rainfall since 1950. The temperature and precipitation forecasts for the end of the century (2100) are even more negative (**Figure 1**).

(b) Transformation of biogeochemical cycles. Since the industrial revolution and due to the exponential growth in the use of fossil fuels and fertilisers associated with intensive agriculture, there has been an **imbalance in the biogeochemical cycles** of almost all the elements, mainly of the three most important: C, N and P (Enrich-Prast et al. 2018). Especially relevant is the **increase in the atmospheric concentration**

of CO₂ (from 285 ppm in 1850 to more than 400 ppm today), as a consequence of burning fossil fuels, and the **loss of reserves due to deforestation of forests in tropical regions and degradation of the soils of the entire planet**. The large amount of N added to the soil annually in the form of fertilisers to improve agricultural production increases the **eutrophication of aquifers** and aquatic ecosystems and causes an increase in nitrous oxide (N₂O) emissions into the atmosphere (Enrich-Prast et al. 2018). Similarly, the **high use of phosphates in intensive agriculture** has also contributed to the eutrophication of natural systems and has altered the P cycle.

(c) Loss of biodiversity. The Mediterranean region is one of the biodiversity **hotspots on the entire planet** (Myers et al. 2000). Specifically, the biodiversity of **Spain is one of the highest**, with around 85,000 species of animals and plants and 30% of European endemisms. However, **this biodiversity is in danger**, since a significant proportion of these species, 14%, are under threat in Europe. **The main direct causes of biodiversity loss are changes in land use, unsustainable use of natural resources** such as water, abandonment of traditional livestock and agricultural uses, pollution, climate change and invasive species (OSE 2010).

A. Change in annual temperature (°C)

B. Change in annual precipitation (%)

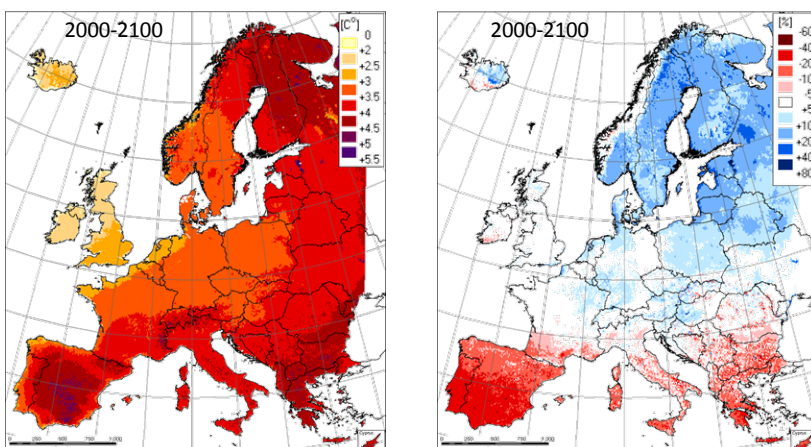


Figure 1. Expected changes in the 21st century in (a) annual temperature (°C) and (b) annual precipitation (%) in Europe. Maps produced in the European project PRUDENCE PESETA I results - Change in mean annual temperature and precipitation by the end of the century. Credit: European Commission Joint Research Centre (JRC). Copyright: European Union - Joint Research Centre (JRC).

■ Rural exodus and its consequences on the landscape: changes in land uses

Studies of the Mediterranean region (e.g., Mazzoleni et al, 2004) and, in particular, of the Iberian Peninsula, show that since the middle of the 20th century the **abandonment of rural areas and the establishment of successional plant communities** are two of

the most important transformation processes. The areas affected by this rural exodus (**Figure 2**) in the latter part of the 20th century cover almost a third (29%) of the natural vegetation systems (Hill 2008). The spatial pattern of this rural exodus reflects the main demographic trends in Portugal and Spain, which are characterised by **strong urbanisation trends and population concentration along the coasts and in the main cities**, in contrast to the decline of the population in the interior. These changes, which have led to industrial and tourist development, are also reflected in the proportion of people dedicated to different socioeconomic sectors (Pausas 2004), with an increase in the industrial and service sectors and a decrease in the primary sector.

This pattern of rural exodus has led to **a very significant decrease in the area devoted to crops and an increase in the forest area throughout the 20th century (Figure 3)**. Spain is one of the countries with the most depopulated rural areas in Europe. This rural depopulation means that these forests, despite increasing, are not cared for, and livestock do not consume the understory. For this reason, **a large part of today's forests is at high risk of fires** which, in turn, can cause desertification in many areas.

■ Abandonment of traditional farms and concentration of production on the plains

Rural depopulation has led to the **abandonment of traditional farms, especially in the mountains**, where the lack of profitability has made most small farms where a traditional agro-silvo-pastoral survival management used to be carried out unviable. These Mediterranean mountain farms have **very low profitability** related to three main factors: (i) **difficult environmental** conditions linked to the Mediterranean climate; (ii) **mechanisation difficulties** due to the steep slopes and small terraces; (iii) **soil degradation** as a result of old harvesting that has left poor soils with a very low organic matter content.

This traditional management has been replaced by the **increasing concentration of**



Figure 2. Abandoned farm recolonised by the forest, Catalonia. Photo: AVVideo.

Area (million ha)

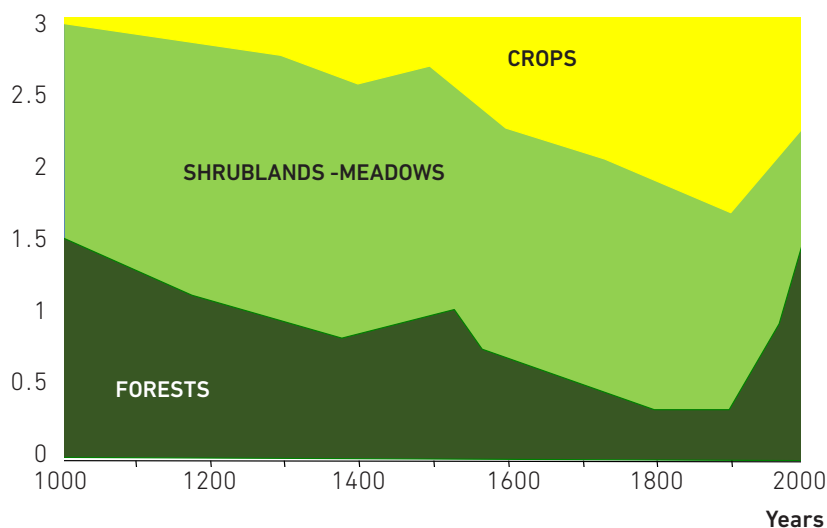


Figure 3. Changes in the main land uses in the last 1000 years in Catalonia. Information prepared by Jordi Peix, unpublished.

large oligopolies in the plains. According to updated data from the Ministry of Agriculture, in Spain there are **1 million farms, but 42% of the total production is obtained in only 6.6% of all of them**. The open and extensive areas of the plain are normally easily machinable and, in general, they opt for obtaining large productions in small spaces. It is common for them to focus on a single product, deriving all the resources for its exploitation. To do this, they exploit the means of production to the maximum and **intensify agriculture and livestock**, increasing inputs (synthetic fertilisers, chemical pesticides, water), and the **capitalisation of companies and labour**. Although the result is a large increase in food production, this type of agriculture and livestock has important environmental consequences such as soil degradation, vulnerability to climate change and loss of biodiversity, and socio-economic consequences, since it generates territorial imbalances and the abandonment and loss of productive capacity of a large part of the territory.