



November 2025

LIFE RedBosques_Clima

Recommendations for adapting forests to climate change

The forests of southern Europe

Forests cover 42% of the European Union's territory and, due to their size, economic value and the services they provide to society, they are one of the continent's most important ecosystems.

The forests of southern Europe have characteristics and realities that, in many respects, differentiate them from those of northern and central Europe. Due to their geographical position straddling several biogeographical regions, the countries of southern Europe are home to a great diversity of forests. In addition to Atlantic forests, such as beech, fir and oak forests, they contain a wide variety of formations characteristic of the Mediterranean region: holm oak and cork oak forests, Pyrenean oak and gall oak forests, pine forests of various species, as well as very rare formations such as Spanish fir forests or, in Macaronesia, relict forests such as laurel forests.

In Spain, forests cover 54.8% of the territory, which includes 27 types of forest considered *Habitats of Community Interest*. Almost a third of the forest area is protected as it belongs to the Natura 2000 Network. These data reflect the high ecological value of our forests and their importance for the conservation of biodiversity.

The forests we know today are the result of their centuries-old use for firewood, charcoal and timber, or for livestock farming, which has conditioned their structure and species composition. This process has been followed by an accelerated abandonment of rural areas as a result of emigration to industrial development centres since the 1960s.

As a result, forest area in Spain has increased by 33% in the last 25 years. Most of this is made up of young forests colonising former pasture or crop areas, together with more than 5 million hectares of reforestation carried out well into the 20th century.

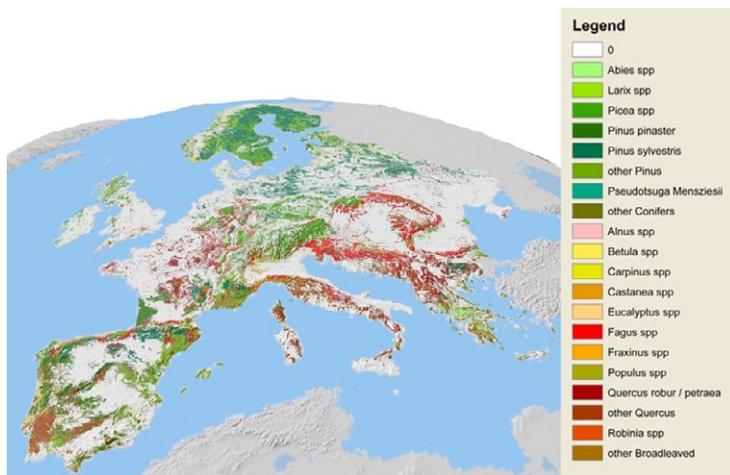


Figure 1. Types of forests in Europe. Source: European Forest Institute

Brus, D.J., G.M. Hengeveld, D.J.J. Walvoort, P.W. Goedhart, A.H. Heidema, G.J. Nabuurs, K. Gunia, 2011. Statistical mapping of tree species over Europe. *European Journal of Forest Research* 131 (1): 145–157.

Effects of climate change

In addition to the changes in the forest landscape caused by abandonment, climate change is now also having an impact, and the effects are evident. In the Mediterranean, the main effects of climate change are manifested not only in rising temperatures, but also in the increased frequency, duration and intensity of heat waves and periods of drought.

The combination of heat waves and prolonged droughts has a direct effect on the weakening of trees, which sometimes leads to mass mortality. Added to this gradual process, which is little known to society, is the increase in the intensity of forest fires.

The current structure of most of our forests is not favourable: young, very continuous, dense and homogeneous forests in terms of age classes and low species diversity are particularly vulnerable to the aforementioned effects of climate change.

It is therefore urgent to take action to improve the adaptability of forests, restoring a structure that is more resilient to disturbances and accompanying an inevitable process of change, so that the services that forests provide us with are not lost.

A society in transformation

Intervention in such a large forest area faces significant challenges. Climatic conditions greatly limit the productivity of Mediterranean forests. This circumstance, together with a terrain that makes access by machinery difficult, means that in many cases forestry is not profitable, limiting the use of silviculture to those areas where mechanised treatment is possible. The rate of forest resource use in Spain is among the lowest of the European Union member states.

Furthermore, an eminently urban society and a rural world affected by intense depopulation have resulted in a lack of labour and an insufficiently developed forestry sector (timber companies, sawmills, logistics operators and technical services). Overall, the direct contribution of the forestry sector to Spain's gross domestic product is 13.5% lower than the European average¹.

¹ SECF. 2013. *La situación de los bosques y el sector forestal en España*. Sociedad Española de Ciencias Forestales.

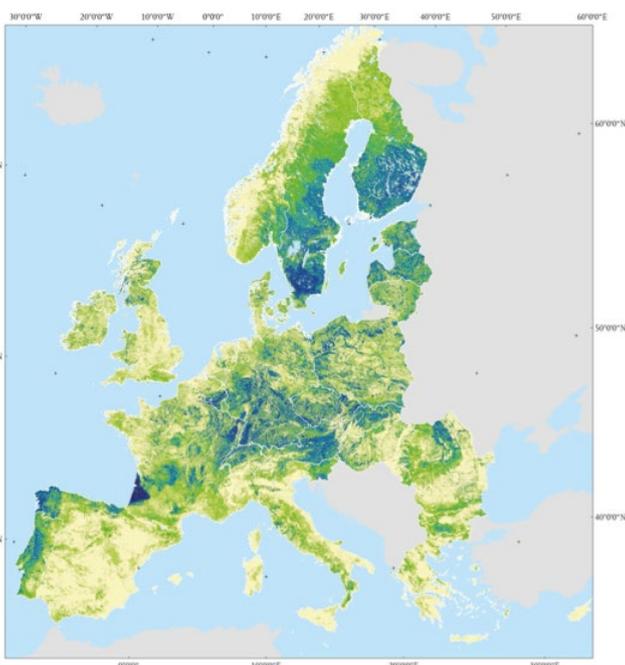
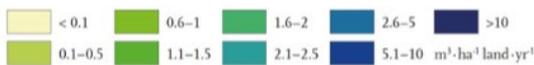


Figura 2. Wood production (m³/ha/year) in Europe, average for the period 2000–2010. Source: European Forest Institute

<https://efi.int/knowledge/maps/woodproduction>

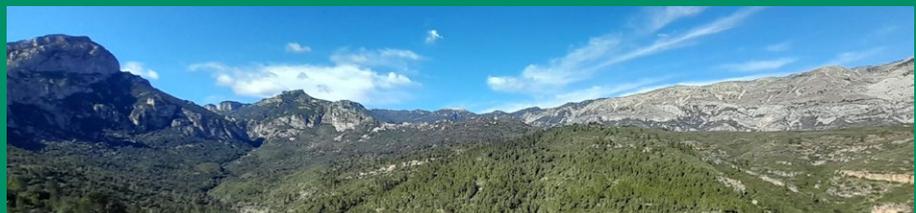
Verkerk, P.J., Levers, C., Kuemmerle, T., Lindner, M., Valbuena, R., Verburg, P.H., Zudin, S., 2015. Mapping wood production in European forests. *Forest Ecology and Management* 357, 228-238.



In summary, in southern Europe, adapting forests to climate change is a high-priority strategy, with certain specific constraints:



- Large expanse of forest land, currently expanding
- High conservation value
- Young forests, highly vulnerable to climate change (droughts, fires)
- Forests sometimes unproductive, forestry not always profitable
- In a context of rural depopulation and abandonment of forest uses



In this dialectic—between the need to intervene and the difficulties in putting that intervention into practice—the LIFE RedBosques_Clima project aims to demonstrate the potential of natural solutions, based on improving the conservation status of forests, as a tool for adapting to climate change.

The following are the main recommendations and conclusions generated throughout the development of the project, both in the different actions aimed at technicians and researchers, and in the implementation of the demonstration cases.

1) Integrate climate change adaptation into planning

- Climate change is a global phenomenon that cannot be addressed at the local level alone. Promoting the adaptation of our forests to climate change requires a comprehensive landscape-level vision. A strategic approach with long-term objectives and a broad territorial scale is necessary.
- Forest management is limited in areas affected by severe depopulation, labour shortages and little or no economic viability for forestry activities. This makes good planning essential in order to decide which areas are priorities for adaptation and to optimise the available resources.
- There is sufficient forest area to incorporate different objectives (forestry, fire prevention, biodiversity conservation, recreational use, etc.). To do this, it is necessary to define the priority or purpose assigned to each element of the landscape, integrating adaptation into these objectives and identifying the most vulnerable areas and possible climate refuges.

2) Leveraging synergies with other sectoral policies

- Measures to adapt forests to climate change have significant synergies with biodiversity conservation policies. Adaptation measures should be aligned with existing climate change, biodiversity and forest strategies at European, national and regional level.
- The Nature Restoration Regulation and its implementation in national restoration plans should be seen as an opportunity to combine ecosystem restoration and climate change adaptation.
- In protected natural areas, climate change adaptation should be integrated into planning instruments (management plans).
- It is considered a priority to promote the incorporation of adaptation into forest management instruments and to move beyond forest-scale management to a more comprehensive landscape-scale approach.

3) Explore nature-based solutions

- Improving or maintaining the adaptive capacity of forest ecosystems is linked to their good conservation status. Well-maintained forests are more resilient to disturbances.
- At the landscape scale, greater resilience is achieved by promoting heterogeneous mosaics (formed by forest stands at all stages of the silvogenic cycle) and diverse mosaics (formed by different types of ecosystems such as forests, grasslands, scrublands or crops).
- From the point of view of adaptation to climate change, spatial heterogeneity, structural complexity and tree species diversity are characteristics that provide greater resilience. At the stand level, promoting these characteristics linked to greater resilience is one of the options for improving adaptive capacity.
- The protection of stands of greater ecological value must be ensured, depending on the specific characteristics of each situation. Planning and prioritisation (where, when and how to act) is considered essential.
- Silviculture can be an essential tool for promoting adaptive capacity when it is aimed at promoting the restoration of processes and elements linked to greater resilience (spatial heterogeneity, complexity, tree species diversity).
- Close-to-nature silviculture is proposed as an option for increasing the adaptive capacity of forests by increasing species diversity at the stand level and increasing spatial heterogeneity. It is based on low-impact actions, but these must be repeated at shorter intervals than in conventional silviculture. These interventions are also low-cost and easier to finance.
- Other tools can be considered for the creation of resilient landscapes, such as prescribed burning, which reduces the amount of fine biomass and maintains open areas in ecosystems adapted to fire and under strictly controlled conditions.
- The action of large herbivores is essential in the creation and maintenance of heterogeneous mosaics. Extensive livestock farming is a fundamental tool in this regard, and its promotion is a challenge in areas affected by severe depopulation. In these cases, the maintenance or restoration of herbivory in free or semi-free range with resistant breeds may be a tool to consider.

- It is considered important to identify adaptation practices with undesirable negative effects (maladaptation). Adaptation measures must be carefully evaluated so as not to conflict with biodiversity values and the preservation of the range of services provided by forests.
- 4) Promote the transfer of scientific knowledge to management
- Forest managers must be provided with practical decision-making tools that translate available scientific knowledge into valid solutions for implementation in the field.
- The exchange of information, the creation of networks of managers and the dissemination of good practices and demonstration cases, as well as the standardisation of procedures, are essential for possible solutions to permeate the decision-making process.
- Adaptation measures must be accompanied by adequate monitoring to assess the extent to which they contribute to achieving the objectives for which they were designed.

5) Ensure the necessary funding

- Adaptation actions require significant investment, and direct returns from timber or biomass often do not cover the costs. Prioritisation at the regional level is needed to identify the forest ecosystems that require the most urgent action and the most efficient types of measures.
- From the point of view of coordinating different policies, the inclusion of adaptation measures in the allocation of CAP funds is particularly relevant. Ecosystem-based adaptation-oriented forest management should become an opportunity to obtain financial resources. To this end, it is necessary to improve dialogue with European fund managers in order to incorporate appropriate actions and criteria for biodiversity conservation in the implementation of Rural Development Programme measures.
- New alternatives to public sources of funding must be explored. The certification of environmental services provided by forests is one of the tools that in the future can contribute to diversifying sources of funding for forest management and involving the private sector and society in the conservation of forest services.

6) Improving governance, communication and awareness

- It is imperative to raise awareness among society in general and forest owners in particular of the impacts that climate change is already having on forest ecosystems, so that the need to take action is recognised. Efforts to raise awareness, communicate and provide training on climate change adaptation, which promote greater social co-responsibility, must be supported.
- For climate change adaptation to be effective, governance systems must be improved and diversified, encouraging greater social involvement and a broader spectrum of stakeholders. This will be key to ensuring that stakeholders take ownership of adaptation measures, participating in their design and implementation, as well as in monitoring their effectiveness.
- Adaptation-oriented forest management requires the participation of private owners, making them aware of the need to improve the state of forest conservation, beyond direct economic benefits. The need to manage climate risks to ensure that the property is kept in good condition must become an incentive for forest management.
- In developing adaptation policies and actions, it is necessary to involve all professionals with expertise in forest management, especially forest managers and those responsible for biodiversity conservation.
- The implementation of adaptation measures in forest management requires a change in mindset at all levels, from policy makers to field workers, in order to incorporate new objectives into traditional management.
- Due to the large area to be managed, adaptation criteria need to be incorporated into ordinary forest management, as is already the case with fire prevention, for example by incorporating these criteria into technical specifications.
- In addition to the necessary attention to legitimate rights and participation, it is necessary to explore ways to move forward in a context of climate emergency that requires immediate action.



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