LIFE RESILIENT FORESTS

Coupling water fire and climate resilience with biomass production from forestry to adapt watersheds to climate change

Layman's Report

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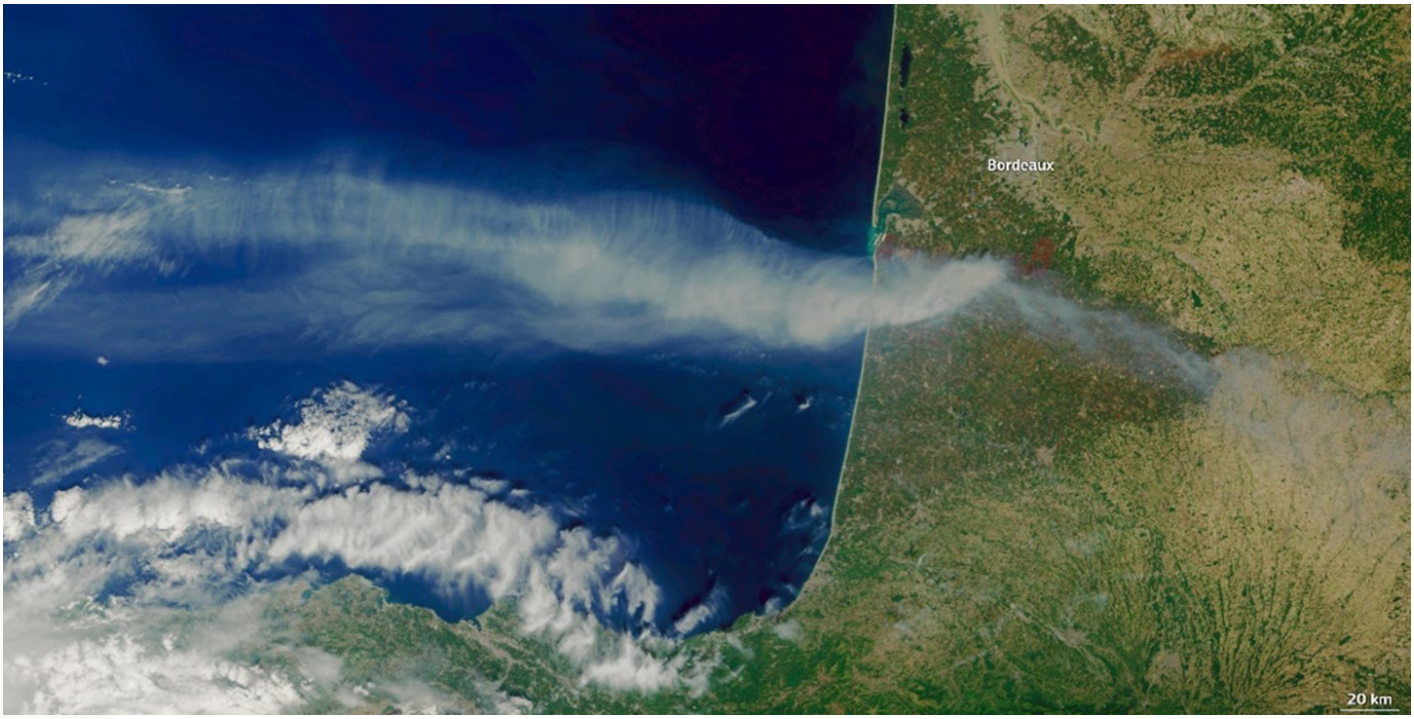
Climate change and forest resilience



Copernicus' Sentinel 3 satellite image show the smoke rising from the wildfire in southwestern France, near Bordeaux, on 10 August 2022. Credit: European Union. Copernicus Sentinel 3 imagery. Processed by @DEFIS_EU

The effects of climate change and climate variability on forest ecosystems are evident around the world and impacts are unavoidable, at least in the short and medium term. Climate change affects forest ecosystems negatively by making forests less resilient to disturbances, such as the reduction of plant growth, the frequency and the intensity of pest and disease outbreaks, wildfires and wind storms.

European forests are under increasing pressure from natural disturbance. Changes in the frequency and intensity of disturbance may reduce the ability of forests to provide ecosystem services, including their potential to mitigate climate change[1]. Between 1950 and 2000 an average of 35 million m3 wood was damaged annually in Europe by disturbances such as storms (53%) and wildfires (16%). The years 2003 and 2007 demonstrated that forest fires can be devastating when large scale droughts prevail.

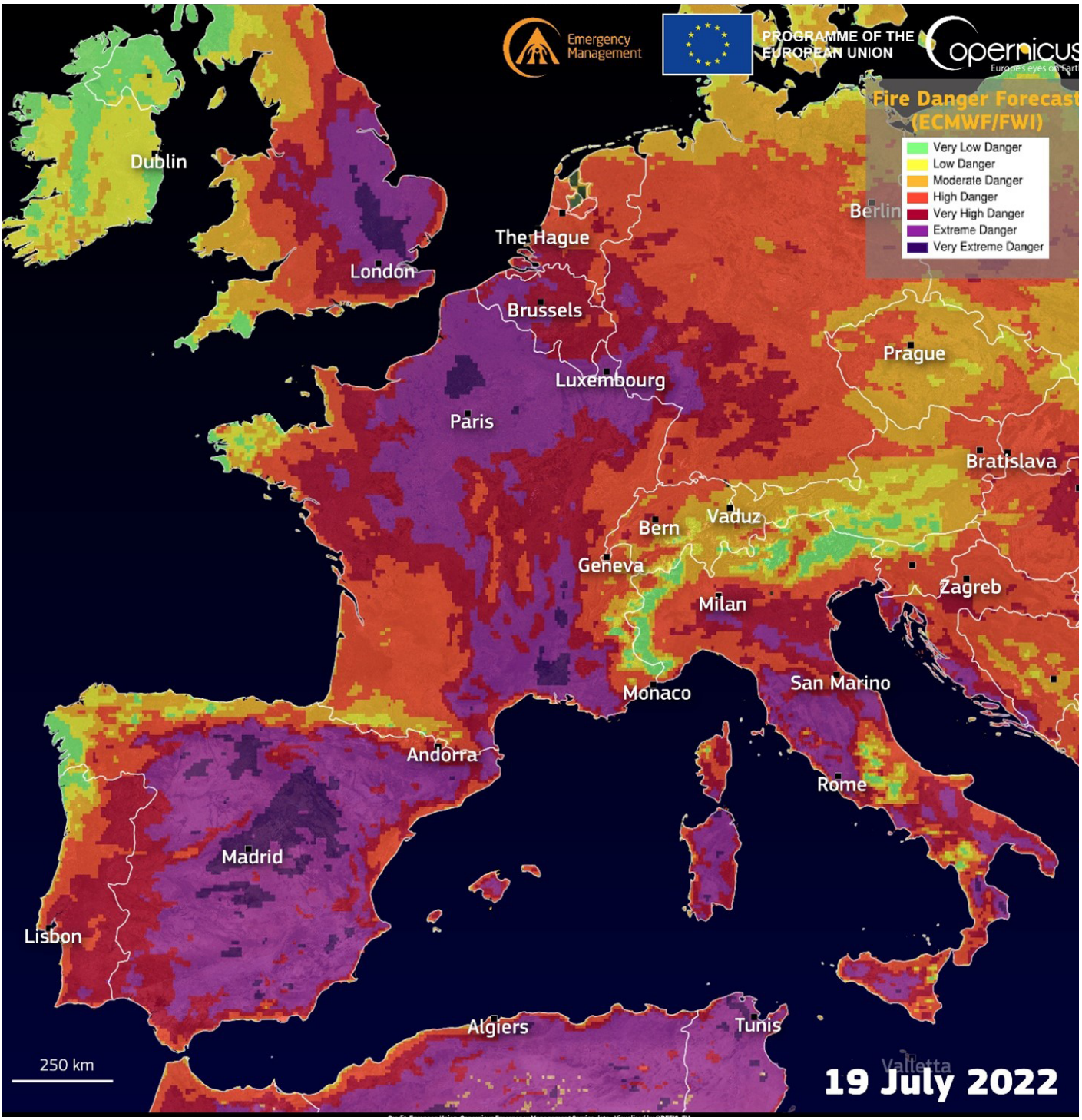
Climate change will increase the number and severity of droughts in many parts of Europe and will affect the availability of water resources.

During the last 30 years, the total EU area affected by water scarcity and droughts doubled from 6 to 13%, economic losses of this increase were estimated at 100 billion Euro. In the last 20 years, 16% of the mean annual harvest in Europe was lost due to disturbances. The most important disturbance agent over the study period was wind (46% of total damage), followed by fire (24%) and bark beetles (17%). The share of total damage due to bark beetle disturbance doubled in the last 20 years.

The frequency and harmfulness of wildfires is also on the rise. According to The European Forest Fire Information System (EFFIS), the summer of 2022 was exceptional, in terms of number of fires observed and of the extent

1. Significant increase in natural disturbance impacts on European forests since 1950, M. Patacca, M. Lindner et al., 2022 https://onlinelibrary.wiley.com/doi/10.1111/gcb.16531

of damaged area. From June to August 2022 the number of detected fires in Europe was higher than the long-term average of 2006-2021. Between late-July and early August, an unprecedented wildfire activity burned up to 130,000 hectares of forests, particularly in the south and south-west of France, in the north of Spain, and in Portugal.



Western Europe ravaged by wildfires in July 2022. Credit: European Union, Copernicus Sentinel 2 imagery.

Forest ecosystem goods and services

Forests cover around 40% of the territory of the European Union and besides being an important pool of biodiversity, they also provide multiple benefits to humans, defined as ecosystem services, such as providing oxygen, food, timber and woodfuel, filtering water supplies, controlling floods and erosion, as well as providing opportunities for recreation, education, and cultural enrichment. Additionally, sequestering carbon from the atmosphere is a major form of ecosystem service provided by forests for climate regulation.

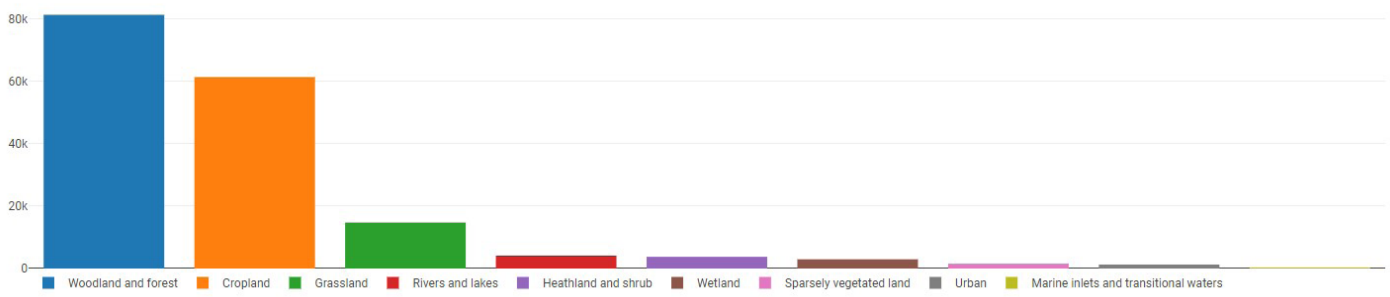
Climate change is a significant driver of forest disturbances that can deeply impact ecosystem services, affecting regional forest resource provisioning, and potentially disrupting long-term forest management planning and timber markets. This is why in anticipation of the wide-scale impacts expected from climate change in the next decades, forest owners and managers should focus on strengthening the resiliency and the adaptive capacity of their forests, by planning and implementing sustainable forest management practices, to ensure their long-term capacity to provide ecosystem services in the future. According to the Forest Information System for Europe, Forest ecosystems contribute to 47.5% of the total ecosystem services, 9 times more than the contribution of urban land.

Economic value from ecosystem services in the EU 28 in 2012, M EUR. Source: Forest Information System for Europe.

One of the most important services provided by forest ecosystems is **carbon sequestration**, whose economic value in 2012 was estimated in **14,739 Million EUR**[2].

Flood control is another major service provided by forest ecosystems, in that they help to protect urban areas and human infrastructures from floods, by regulating the water runoff during heavy rain and also by storing water into the soil. It is estimated that forest ecosystem represent over 70% of flood control areas in the EU. **Water purification** is another ecosystem service provided by forests that remove pollutants from the environment, reducing the need for artificial water purification systems. For example, the economic value of nitrogen removal provided by forests is estimated in up to **15,364 M EUR** in 2021.

Forests also provide an important service to humans for **recreational activities**, as the COVID-19 pandemic demonstrated the importance of having daily access to natural areas for recreation as an important factor for well-being. The economic value of recreation opportunities that people have in forests located within 4km from their settlements was estimated at **30,273 M EUR** in 2012 for EU 28.



Economic value from ecosystem services in the EU 28 in 2012, M EUR. Source: Forest Information System for Europe.
Source: Forest Information System for Europe.

2. https://forest.eea.europa.eu/topics/forest-biodiversity-and-ecosystems/forest-ecosystem-services

Sustainable Forest Management and its relationship with ecosystem services

In 1993 the Ministerial Conference on the Protection of Forests in Helsinki defined Sustainable Forest Management as the stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfill, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems.

Sustainable forest management practices deliver social, environmental and economic benefits to forest owners and local communities.

Since European forests are highly diverse, sustainable forest management practices should always be tailored to the needs of the specific forest ecosystems, as well as to local framework conditions and the socio-cultural context.

However, six criteria for sustainable forest management that should be universally applied at European level are[3]:

1. Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles;
2. Maintenance of forest ecosystem health and vitality;
3. Maintenance and encouragement of productive functions of forests (wood and non-wood);
4. Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems;
5. Maintenance and appropriate enhancement of protective functions in forest management (notably soil and water);
6. Maintenance of other socio-economic functions and conditions.

3. Source: Forest Europe- Third Ministerial Conference on the Protection of Forests in Europe 2-4 June 1998, Lisbon/Portugal Link.

LIFE RESILIENT FORESTS

LIFE RESILIENT FORESTS is a project co-funded by the European Union's LIFE Programme to promote a forest management approach at the watershed scale that improves forest resilience to wildfires, water scarcity, environmental degradation and other effects induced by climate change.
The overarching goals of LIFE RESILIENT FOREST are to:

1. To quantify the ecosystem services that can be obtained through different sustainable forest management practices;
2. To optimize the provisioning of multiple ecosystem services from sustainable forest management.

The project was launched in 2018, and involves five partners from four countries, (Spain, Portugal, Belgium, Germany) under the coordination of the Research Institute of Water and Environmental Engineering (IIAM) at the Universitat Politècnica de València.
Inspired by these goals, LIFE RESILIENT FORESTS has conducted a range of activities in some of the partner countries that are briefly described in the following pages.

Development of a Decision Support System for Multi-objective Forest Management

Although forests can provide multiple ecosystem services including wood and timber production, water management, carbon sequestration, biodiversity protection etc., usually management operations such as thinning, cutting and replanting are planned and carried out in a way to prioritize only one particular goal at a time.

For example, forest managers may decide to intervene in a mature forest stand to harvest timber or woodfuel, or to reduce the biomass density to prevent the risk of wildfires, to manage the risk or floodings, to remove plants infested by pests etc.
However, any type of forest operations always affects the provision of all the ecosystem services as a whole, therefore quantifying the effects of forest management operations on each single ecosystem service and their distribution in space and time is an important element that managers and owners should be able to consider, when designing a sustainable forest management plan.

For this reason, LIFE RESILIENT FORESTS developed CAFE (Carbon, Aqua, Fire & Eco-resilience), a Decision Support System (DSS) designed for forest managers, enabling the decision making process of forest managers when dealing with multi-criteria forest planning.

CAFE determines the optimum design of forest management activities needed to obtain multiple products, goods and services such as biomass production, carbon sequestration, reduction of fire risk, water provisioning and management, climatic resilience or biodiversity.

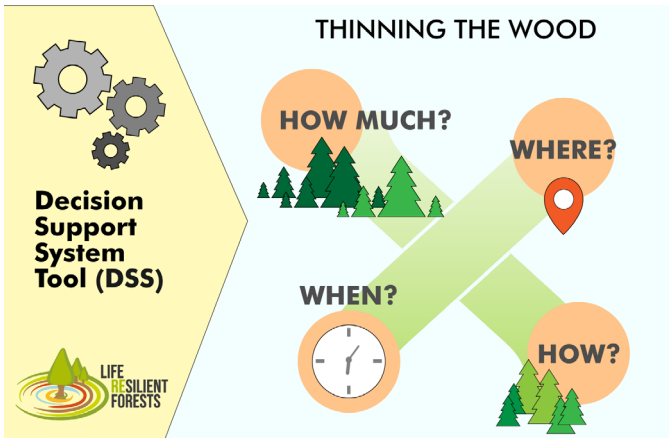
The tool simultaneously quantifies all these ecosystem services in time and space for a selected solution in a given location, providing details on the management intensity, forest

working units selection, frequency and type of management (thinning/plantation). By adopting this multi-criteria approach, managers can plan the activities and operations needed to increase the resilience of local forests to changing climate conditions, whilst ensuring their long-term provision of all the ecosystem services.

This open source and open access tool was already used in its early stages to guide the decisions of local administrators and managers in multiple locations in Spain and in Portugal.
CAFE combines eco-hydrologic dynamic simulation with multi-criteria optimization, where the user can carry out forest management according to more than one product at the same time, and choose the relevance of each objective. In addition to optimizing up to 5 metrics, it also allows to quantify the effect of management on all goods and services, including the ones for which the management scheme is not optimized.
The tool answers the classical Forest Management questions:

1. how much should I thin my forest?
2 . when should I plan the next intervention?
3. where should I intervene in the forest stand?
4. which trees should I cut or leave?

Forest management schemes designed with the CAFE tool can be optimized for multiple ecosystem services



CAFE is entirely open source and free to use, it can be applied to different climatic regions and at any spatial scale from forest stand to landscape level. It can be used with current climate data or for future climate scenarios.

carbono, agua, fuego y eco-resiliencia
c.a.f.e.

Download the software for forest managers here.

Demonstration of the DSS tool and forest management scheme in Spain and in Portugal

Case study in the Municipality of Serra

One of the first applications of CAFE addressed a real case study in the public forest of the municipality of Serra (Valencia, Spain).[4]

The area of the study is a mountain territory located inside the Parque Natural de la Sierra Calderona, at an altitude between 250 and 800 meters above sea level, with an average temperature of 17° C and very irregular mean rainfall ranging between 300 ± 76 mm in the last 17 years, therefore classified as a Mediterranean semi-arid climate.

The forests extend over an area of 2,982 Ha, 248 of which are managed with periodical cuts, and are mainly populated by Aleppo pines (Pinus halepensis), holm oak (Quercus ilex), cork oaks (Quercus suber) and maritime pine (Pinus pinaster).

The use of CAFE provided accurate information about the current state of ecosystem service provision in this area, as well the needs and the objectives that should be addressed by the forest management plan.

The results indicated an annual water percolation around 26 mm/year and **carbon sequestration rate of 6 t/ha per year,** both values indicating a relatively low level of productivity as typical of semi-arid forest ecosystems, for which a sustainable forest management scheme is a fundamental tool to cope with climate change.

The optimization scenario drawn with the use of the CAFE tool indicated that a multi-objective management scheme in this area could **reduce the average risk of fire by 2%**, as well as **reduce the number of days with high risk of fires by 20%**, while increasing the **structural biodiversity of the forest by 14%** and strengthening its **climate resilience by 7.6%.**

An example of managed forests stands (left) and unmanaged forest stands (right) inside the Parque Natural de la Sierra Calderona.

4. PÉREZ ROMERO, J., GONZÁLEZ SANCHIS, M. 8mo Congreso Forestal Espanol, 2022

Quantification of water provision and other ecosystem goods and services provided by forest plantations in the Basque country

The Basque country in Spain is traditionally an area of wood production from forest plantations for timber and pulp, yet the oscillations of wood market prices and the socio-economic changes that affected the region in recent times, could potentially hamper the future supply of both wood products and of the ecosystem services of the forest plantations.

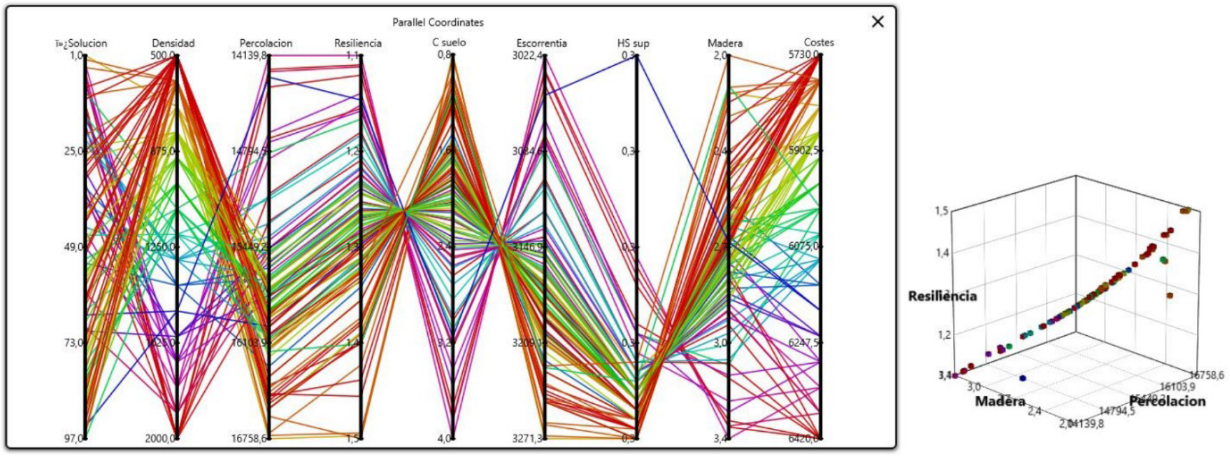
Detail of the expertimental plot in the area of the study.

The CAFE tool was applied to a pilot case to quantify the ecosystem services of forest plantations in the municipality of Berriatua[5]. The work highlighted the important role of forest plantations beyond wood production, to regulate the management of water, as well as their potential for carbon removal, therefore justifying the importance of their management, to increase their resilience to climate change.

The analysis revealed that an intensification of the tree density coupled with a reduction of thinnings leads to an increase in wood yields, while the opposite leads to a higher availability of water in the watershed.

This indicated the need to adopt a forest management scheme based on the future climate scenarios and projections for this area, that can optimize at least the provision of water, carbon sequestration and eco-resilience.

This work provided the forest managers of the area with a scientific base to build on for their future forest management choices, through the quantification of the ecosystem goods and services provided by the forest plantations, as well as the design of the management scheme that maximizes their combined provision.



The Pareto front chart displaying the different optimization scenarios as result of the CAFÉ tool applied to the case study in Berriatua.

5. Las Plantaciones Forestales y los Servicios Ecosistémicos: un Caso Práctico en el País Vasco -GONZÁLEZ-SANCHIS, M., DEL CAMPO GARCÍA, A, 2022, 8o Congreso Forestal Espanol

Reforestation Action in Serra da Estrela (Portugal)

The Serra da Estrela Natural Park was the first to be created in Portugal and contains the largest protected area in the Country, with about 101,000 hectares.
Its rugged topography with crags, rocks and imposing cliffs culminates in the highest point in mainland Portugal at an altitude of 1,993m.

In October 2017 the wildfire that occurred in the region of Serra da Estrela caused a burned area of 17,000 hectares, and in August 2022 Serra da Estrela was the stage for one of the largest fire events ever registered in Portugal with 27,000 hectares of burnt area, a significant area of protected landscape was lost and the impacts on the ecosystem were devastating.

An afforestation action was organized by Associação para o Desenvolvimento da Aerodinâmica Industrial (ADAI) close to Manteigas, in Serra da Estrela, in one of the burned areas in the fire complex of October 15, 2017.

The project designed the afforestation plan using the CAFÉ Decision Support Tool (DSS) to quantify the goods and services provisioning of the afforestation and the maintenance activities, optimizing the tree density, and selecting among the possibilities, the best spot to develop it.

This initiative showed the usefulness of the DSS tool and established a validation point that will provide useful data to validate and improve the DSS tool in the future.

The afforestation action started symbolically on January 12, 2023 and involved the local community of Manteigas (schools and associations) and all people interested in participating.

The initiative had the association of several activities namely the Municipality of Manteigas, the Institute for the Conservation of Nature and Forests (ICNF) and "Community Lands Association of Santa Maria" and several schools and Social solidarity associations of Manteigas. In total, 3300 trees of the Pinus sylvestris and Quercus pyrenaica were planted.

The afforestation day in Manteigas (PT) on 12 January 2023. Source: ADAI.

A Mediterranean perspective to EU forest policy

Aligning forest-related Mediterranean LIFE projects with EU climate and biodiversity targets in the frame of the European Forest Strategy

European forests play a key role in the European climate-change mitigation strategy (European Green Deal) the Biodiversity Strategy, the revision of the LULUCF Regulation, and other policy files.
In 2021, the presentation of the New EU Forest Strategy for 2030 by the European Commission was a major milestone in the effort to align EU forest policies with the overall objectives of the European Green Deal.
In doing so, it aims to turn European forests into a major contributor to the biodiversity and climate goals and to put the forest economy at the service of the construction of a new bioeconomy.
The future of EU forest-related policies is of paramount importance for Mediterranean forests, which are particularly vulnerable to climate change, and whose resilience is key to contributing to the EU bioeconomy, climate, and biodiversity targets.

LIFE projects have both the commitment and the potential to provide sound and ground-based evidence to enrich policymaking towards sustainability.
For these reasons, in 2022 LIFE RESILIENT FORESTS took the initiative to gather eight forest-focused LIFE projects in the Mediterranean to join their forces to co-produce a policy paper, based on the shared and diverse knowledge stemming from their respective activities.
The paper described in the following pages aims at calling attention to the specificities of Mediterranean forests in fitting into the approaches adopted on the EFS and to contribute to an effective and fair implementation of the EU, national and regional interventions based on the EFS 2021 in Mediterranean forests, so that they can contribute to the bioeconomy, climate and biodiversity targets that we all share.

The joint paper is the result of a collaborative work carried out by the representatives of the projects LIFE ADATP ALEPPO, LIFE RESILIENT FORESTS, LIFE SYSTEMIC, LIFE WOOD FOR FUTURE; MIDMACC, MIXFORCHANGE LIFE AGROADAP and LIFE FOREST CO_2.

Understanding the specificities and needs of Sustainable Forest Management in the Mediterranean

Sustainable forest management (SFM) becomes the backbone of the EU Forest Strategy, which emphasizes that SFM must consider the three inter-dependent pillars of sustainability: environmental, economic and social. SFM requires the implementation of forest practices and works aimed to secure the provision of multiple ecosystem services, however, **a common feature of Mediterranean forests is the lack of any management**[6] and forest abandonment in a very important part of (mainly private) forest and with **very low harvest rates**[7]. This insufficient or inexistent management leads to forest encroachment causing **loss of mosaic habitats and of biodiversity**.
This is associated with shrublands and grasslands, an increase of fuel load, and a decline of goods and services provisioning. Furthermore, the lack of adaptive management is strongly impairing forest resilience and/or resistance to climate change, aggravating other destructive stressors (in particular drought, pests and diseases, and windstorms), and it also affects forest fire behaviour and regimes.

Although there are several factors explaining insufficient management of Mediterranean forest, **low or inexistent private economic returns** are a key explanation. This is linked to **low forest productivity**, highly **fragmented** and **poorly accessible** production units, **loss of associated wood industry, lack of cooperation** among forest owners, and the lack of an appropriate framework of **private and public incentives**. Moreover, the excessive administrative burden from a not always properly tailored regulatory framework has been found to be an additional constraint to forest management.

In order to avoid a one-fits-all approach with regard to guidelines and regulatory frameworks or the design of incentives for SFM, it is essential to start from a sound knowledge of the situation, trends and challenges of forest ecosystems.
However, there is still insufficient knowledge about the way different Mediterranean forest management models provide multiple ecosystem services. There is also a necessity for long-term monitoring and robust scientific data to see the benefits of forest management in a changing climate context.
Some examples stemming from these LIFE projects are:

1. the way **thinning practices have the potential to increase ecosystem services** like water regulation, structural biodiversity or carbon sequestration;
2. the need to undertake **more research on the quality and usefulness of Mediterranean forest** to contribute to the wood-based construction sector (e.g. the potential of the mechanical properties of Pinus halepensis for laminated wood);
3. The **synergies between trees and grassland in multi-purpose silvopastoral systems** and its economic benefits for rural population.

The knowledge gap regarding the influence of forest management on the genetic diversity of tree populations is particularly relevant, as many forest tree species are found to be threatened or subject to genetic erosion

"Thinning practices have the potential to increase ecosystem services like water regulation, structural biodiversity or carbon sequestration"

6. Camia A. et al. (2021) The use of woody biomass for energy purposes in the EU. Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-27867-2, doi:10.2760/831621.

7. Rojo-Alboreca A. (2015) El reto de la ordenación de los montes privados en España. Cuadernos de la Sociedad Española de Ciencias Forestales 39: 275-297.

due to inappropriate forest management. **Silvicultural techniques which enhance genetic diversity must be recognized**, introduced, planned, and implemented.

Conservation of genetic diversity is one of the main measures to minimize the negative impact of climate change on forest ecosystems.

Genetic adaptation and plasticity are key traits that must be considered in adaptive forest management to climate change such as assisted migration.

In any case, further efforts in research and innovation projects are required in the Mediterranean to feed evidence-based policies that avoid the pernicious effects of one-fits-all interventions.

Tailoring EU Forest Policy to enhance SFM in the Mediterranean

SFM guidelines are of help to steer foresters. However, it is imperative to avoid one-fits-all approaches. These LIFE projects precisely show the necessity to adapt any recommendations to the specific characteristics and needs of each territory.

For instance, thinning can notably and simultaneously increase several ecosystem services like blue water provision, biomass production, carbon storage and forest resilience. Furthermore, appropriate forest management based on decision support tools has the potential to overcome the trade-offs between biomass production and biodiversity conservation -one of the main concerns of the EFS and allows for win-win solutions. In Mediterranean forests, climate change mitigation and adaptation are the two sides of the same coin as biophysical changes in mountainous regions (the norm in the Mediterranean) can be very heterogeneous even in reduced areas; here, SFM must be very site-specific to deploy both adaptation and mitigation strategies.
SFM guidelines must be consequent with this potential and include reliable forest treatments that address both future habitat change and ecosystem services provision under different scenarios.

For SFM to be effectively implemented, foresters' skills need to be improved, as shown by some of the LIFE projects participating in this initiative. This is in line with the invitation that the EFS makes to forest stakeholders to join the Pact of Skills. The development of new skills needs to incorporate territorially adapted knowledge, co-constructed by a diversity of stakeholders: scientific actors, public administrations, private sector and local communities. The skills of those target groups in the field of SFM can be efficiently improved with different decision support and knowledge transfer tools developed within LIFE and other projects (such as GenBioSilvi model, Marteloscopes, etc).

Forest interventions funded by the EAFRD have been found[8] to mean the difference with regards to forest intervention (i.e. lack of 'deadweight') and coherent with multiple environmental objectives. In addition, they provide opportunities for efficient joint application in small-scale holdings which dominate Mediterranean forests.

"Sustainable Forest Management must be very site-specific to deploy both adaptation and mitigation strategies"

8. ALLIANCE ENVIRONNEMENT EEIG (2017) Evaluation study of the forestry measures under Rural Development. European Commission, Brussels. ISBN 978-92-79-65576-0

However, the heavy administrative burden for beneficiaries keeps being a constraint. Member States should increase the scope of forest EAFRD intervention to shape an enabling framework of incentives (e.g. economic, knowledge transfer and advisory) to promote the mainstreaming of SFM in the Mediterranean. Furthermore, the Common Agricultural Policy might be able to recognise the role of pastures under forests, a widespread model of silvo-pastoralism in the Mediterranean which plays an outstanding role in preventing fire, encroachment and loss of open areas.

Collective action is essential for both economic viability and SFM in settings dominated by small-scale holdings. Public policies -at any level of decision making should ease the setting up of collective agreements. Thus, guidelines, incentives and regulatory tools would need to adapt and promote collective forest management. For instance, it is necessary to be aware that forest management strategies go beyond the boundaries of individual stands. A key approach to risk management is to increase the diversity mix of tree species, forest structures and forest management approaches between neighbouring stands to increase the adaptability of forests and improve their resilience to climate change in local environment.
In order to help preserve genetically diverse forest tree populations, monitoring of the genetic diversity is becoming increasingly important, and it has to be systematically incorporated into SFM. To achieve this goal awareness about the importance of forest genetic monitoring (FGM) should be raised among policy makers and experts. FGM should be incorporated into long-term strategies, such as the European forest genetic resources strategy, as well as the Biodiversity strategy, and the European Forest Strategy. In the long-term forest genetic monitoring shall allow an improved adaptive forest management system to enhance the resilience of forests to climate change.
Finally, forest policy design, implementation and evaluation need to adopt a cross-sectoral and systemic perspective, overcoming reductionist and simplistic approaches. This would require an open and inclusive interaction with the several stakeholders, interests and views at stake. For this to be tackled realistically, a territorial focus is necessary. Moreover, this territorial focus must also consider the functional relationships between rural and urban areas, framed into a balanced governance framework able to give rise to an inclusive and fair bioeconomy.

“Recognise the role of pastures under forests, as a widespread model of silvo-pastoralism in the Mediterranean, which plays an outstanding role in preventing fire, encroachment and loss of open areas”.

“Awareness about the importance of Forest Genetic Monitoring should be raised. FGM shall allow an improved adaptive forest management system to enhance the resilience of forests to climate change”.

The joint paper was officially presented in Brussels with a partner event of the EU Green Week on the 31sr of May 2022.

Education and outreach

During the lifetime of the project, LIFE RESILIENT FORESTS has conducted multiple outreach activities to inform and to raise awareness about the importance of Sustainable Forest Management for Mediterranean forests. Here are a few highlights

Reduce tu Huella features RESILIENT FORESTS

On the 10th of October 2020 , the Spanish TV programme “Reduce tu huella” (reduce your footprint) broadcasted an episode focussing on the wildfires that have plagued Spain in recent years and how they have been managed. It was the chance to talk about forest management and the experience of the project Resilient Forests was presented.

Antonio del Campo and Maria Gonzalez Sanchis from the Universitat Politècnica de València were interviewed regarding the systems for checking the water consumption of the forests near the town of Serra (Serra Calderona). Then the biomass production plant in Serra was showed, explaining the circural system put in place here. Thanks to the data gathered, the Municipality knows which trees have to be cut, these trees then head for the plant in Serra and are transformed into wood pellets, used by the Municipality for heating public buildings and also sold to the local community at cheap prices.

Watch the video

El Pais - How to manage forest wildfires

In January 2020 following the devastating forest wildifres that occurred in Spain, the Spanish national newspaper El País interviewed RESILIENT FORESTS coordinators and visited the biomass pelletization plant in the Municipality of Serra, that produces wood pellets from the residues of forest management. With this initiative, the town avoids the emission of 83 tons of CO2 per year.

Watch the video

“The soil give life to everything, if we lose the soil we also lose the capacity to keep forests and vegetation. When the forest is lost, the soil degradates and the carbon stock also goes lost.”
Prof. Antonio Del Campo, Universitat Politècnica de València.

If the tree has more water, it is more hydrated, it grows more and it has greater ability to deal with the problems resulting from climate change.
Prof. Maria Gonzalez Sanchis, Universitat Politècnica de València

Reforestation Day in Portugal

Within the scope of the LIFE Resilient Forests Project, a reforestation action was organized by Associação para o Desenvolvimento da Aerodinâmica Industrial (ADAI) close to Manteigas, in Serra da Estrela.

A symbolical afforestation day on January 12, 2023 involved the local community of Manteigas (schools and associations) and the citizenship and it was featured in the local Beira Alta TV.

Watch the video

Miguel Almeida – ADAI explaining LIFE RESILIENT FORESTS at the Reforestation Day in Manteigas (Portugal) in January 2023.

RESILIENT FORESTS VIDEO SERIES – A Trip inside the Parc Natural de la Sierra Calderona

This series of short clips was filmed in March 2019, during a trip across the Parc Natural de La Sierra Calderona, in the region of Valencia, visiting examples of best practices in sustainable forestry. Learn about how climate change is already affecting the forest ecosystem in the area, and about how Sustainable Forest Management can be a solution for more resilient forests and for the growth and well-being of rural communities.

1 - The riverbed

One of the tangible effects of climate change can be observed in the behavior of rainfalls, which are becoming less frequent and more intense over time, particularly in Mediterranean areas such as in the region of Valencia. Increasing the water retention capacity of watersheds is vital to adapt to these changing conditions. This starts with adopting a sustainable management of forest areas to make soils in mountain regions more capable of storing water.

Video

2 - The Solarium

The effects of climate change are already tangible in our daily life. Just after entering the parc, we stopped at a once popular picnic and leisure area for the citizens of Valencia, which has become an arid and dusty land in less than ten years. Sustainable forest management system must be implemented to make forests more resilient to climate change before it's too late.

Video

3 – The Big Old Tree

"El Pi de La Bassa" was maybe the oldest tree in the Parc, which had witnessed the history of Spain in this region for over 200 years. The long and intense drought of 2014 severely stressed the tree, which was then attacked by the pine beetle and thus became weaker and weaker. After several attempts to save it by the parc administration, a windstorm fell the tree in 2016.

Video

4 – Managed Vs Unmanaged Forests

We stop at a site showing a plot of recently managed forest next to a dense stand of unmanaged forest. Antonio Del Campo and María González Sanchis explain the differences between the two and why it is important to adopt a sustainable management system to make those forests more resilient.

Video

5 – Declining Tree Circles

Thanks to the analysis of the tree-trunk-slice it is possible to observe the real growth of the trees. Antonio shows us, in the middle of the trunk the rings are wider, but when observing the last ones, the rings are very close one to each other. This means that in the last years the tree growth has been slower and slower, as a clear sign of a declining forest.

Video

6 – Experimental Forest Plots
At this experimental site inside the parc, IIAMA-UPV researchers are measuring the amount of water available to feed the trees in a managed forest plot, versus an unmanaged one. In both plots there are facilities that collect the falling water and a monitoring system to perfectly measure how much water the trees absorb from the soil.

Video

7 – Restoring tree growth
Once at the experimental plots we can clearly see the difference between an unmanaged forest originated 27 years ago after a wildfire and a stand of managed forest. Just seven years after thinning, the trees show an increased trunk thickness and a stable growth.

Video

8 – The benefits of Sustainable Forest Management for rural Communities
On our way back to Valencia we visit the town of Serra, a success story and a case study of the benefits of adopting a sustainable forest management system for rural communities.

Video

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