

How are European forest ecosystems doing?



To sustain their multiple services, forests must be both resistant and resilient. Resistance refers to a forest's ability to resist or withstand external pressures such as pests, disease or natural disturbances. Resilience refers to a forest's ability to recover and adapt after a disturbance. Maintaining healthy forests requires a combination of strategies, including sustainable management practices, landscape-scale planning, and proactive efforts to address the impacts of climate change. This way, forests can continue to provide the many benefits that society depends on, both now and in the future.

Key messages

- ➔ The current state of European forests is a mixed picture of improvement and deterioration.
- ➔ The tree canopy mortality rate has doubled since the late 20th century. It is equivalent to 1% of the EU-27 forest area dying yearly.
- ➔ Forest health monitoring at the European level estimates that one out of four trees shows moderately to severely damaging levels of defoliation. It also reveals that defoliation is increasing, which points to a critical condition.
- ➔ The average damage from natural and human-made disturbances to total timber volume amount to a loss of about 79 million m³ annually, corresponding to 16% of the EU's annual wood harvest.
- ➔ Recent management practices have been somewhat effective in improving forest conditions. For example, about 42% of forests exhibit improvements in deadwood volume, forest area, biomass volume and productivity.

Why are healthy forests important?

What makes a forest healthy? The answer depends on who is evaluating it, its use and its management objectives. There needs to be an agreed-upon, simple and recognised definition for a healthy forest. However, the health of a forest is intrinsically linked to its resistance and resilience; this forms the basis of its functioning and ability to provide many forest ecosystem services. These services bring multiple benefits, from protecting plants and animals to providing clean water and air. They maintain vital ecosystem dynamics, including adaptation to and mitigation of climate change impacts.

Natural disturbances are part of forest dynamics. They secure forest renewal and succession by releasing nutrients from affected trees and reducing competition among surviving and newly-established trees. In addition, an increased amount of deadwood favours many habitats, improving biodiversity. Nevertheless, extreme events and disturbances from specific, cumulative pressures impact the health of European forests and their capacity to maintain optimal ecosystem functions,

Publications

structure and composition.

Sustainable forest management is critical to protecting European forests and ensuring their long-term health. This involves balancing forests' economic, social and ecological functions and ensuring that they are managed in a way that preserves their ecological integrity. Forest restoration is also essential, as it can help restore degraded forests and increase their capacity to sequester carbon and support biodiversity.

Box 1. Forest management

Forest management is defined as managing forests to achieve the manager or owner's specific goals. For example, producing wood may involve thinning, harvesting and regeneration treatments. The well-known 'non-active management approach' may be more suitable for other management goals, such as recreation or conservation. Regardless of management practices and no matter how remote, all forests may be significantly affected by indirect human impacts. These include pollution, increasing atmospheric CO₂ concentrations, climate change and invasive alien species.

How are European forests doing?

The current state of European forests is a mixed picture of improvement and deterioration. Some indicators, such as structural indicators, biomass volume and productivity, suggest improving forest conditions. Yet others, such as defoliation, tree canopy mortality and deadwood, suggest critical conditions.

Several assessments document increased damages. The ICP Forests monitoring of forest ecosystems (Krüger et al., 2020) states that one out of four trees assessed shows defoliation levels suggesting moderate to severe damage with an upwards trend in defoliation, pointing to a critical condition (Potočić et al., 2021). The deterioration in forest condition is explained by the variability of and long-term changes in climate and nitrogen deposition, and by forests' interactions with insects and pathogens. This capacity to link tree information with forest ecosystem processes is critical to identifying ways to improve European forests' resilience and adaptive capacity.

Publications

Across Europe, tree canopy mortality is accelerating by 1.5% ($\pm 0.28\%$) annually (Senf et al., 2020). This is double the rate in the late 20th century and is equivalent to 1% of the EU-27 forest area dying yearly. The highest canopy mortality rate over the past 30 years was observed in 2018 (1.14% ($\pm 0.16\%$) per year). A continued increase in canopy mortality at these rates would inverse the current ageing trend in Europe's forests. This would lead to considerable shifts in the age structure of Europe's forests and affect carbon storage and biodiversity, as mature forests have high carbon stocks and provide valuable habitats.

The average damage from natural and human-made disturbances to total timber volume amount to a loss of about 79 million m³ annually, corresponding to 16% of the EU's annual wood harvest (Patacca et al., 2022). Abiotic disturbances (i.e. drought, snow, ice, hail and rime) accounted for 6% of the total timber volume damaged, increasing almost sixfold in 70 years up to 3.7 million m³ per year between 2010 and 2019. However, peaks in individual years have been even higher, reaching 7 million m³ in 1980 and almost 13 million m³ in 2007. Other biotic disturbances such as fungi, nematodes, other insects, pathogens and animals damaging trees account for 8% of the total timber volume damaged, with a sharp increase after the 1980s.

Efforts are being made to improve forest conditions, with 42% of forests exhibiting at least four improvement indicators. Maes et al. (2020) identified improving trends for four forest indicators: deadwood, forest area, biomass volume and productivity (Figure 1). However, the authors also estimated that 47% of the EU's forests are exposed to at least three degradation drivers and 20% to at least four. The evaluation points to increased defoliation, supporting the estimates provided by ICP Forests for the last 20 years. Only 20% of forests are exposed to one or no degradation drivers.

A recent EU ecosystem assessment (Maes et al., 2020) highlights challenges in some regions and for specific tree species. This includes the impact of climate change on forests, such as changes in precipitation patterns, and the increasing frequency and severity of droughts and forest fires. Certain tree species are at risk, such as the spruce forests in central Europe, which have been affected by the bark beetle outbreak. The report also notes that some forests in the Mediterranean region are under stress from a combination of factors, including drought, wildfires and land use change.

Figure 1. Trends in forest health per decade from 1990 to 2020

Publications

Trends in forest condition, % per decade

Improving



Deteriorating



Source: Maes et al. (2020).

Pollution and invasive species remain a concern in European forests, and changes in environmental drivers and disturbance regimes consistently increase mortality and reduce potential carbon storage. Overall, more research and action are needed to address the challenges facing European forests, increase their resilience and adaptive capacity, and ensure their sustainability over the long term.

EU policies related to forest ecosystem health and biodiversity

The EU set ambitious targets for forest restoration as part of its broader efforts to address climate change and biodiversity loss. The EU forest strategy for 2030 and the proposed Nature Restoration Law aim to strengthen the biodiversity objectives (protection, restoration and resilience of Europe's forests) and are crucial to achieving a sustainable and climate-neutral economy by 2050. Forest restoration is critical for addressing Europe's many environmental and social challenges. By restoring degraded forest ecosystems and promoting sustainable forest management practices, such as reduced-impact logging and the promotion of certified sustainable forest products, Europe can help

Publications

mitigate climate change, preserve biodiversity, and provide society with a range of essential ecosystem services. These services include carbon sequestration, water regulation and biodiversity conservation.

Under the European Green Deal, the EU has committed to planting 3 billion additional trees by 2030 and increasing the resilience and biodiversity of existing forest ecosystems. The EU and its Member States are implementing various policies and initiatives that support forest restoration to achieve these goals. These include funding for reforestation and afforestation projects, support for sustainable forest management practices, and the development of green corridors and other landscape-scale approaches to forest restoration.

In addition to these efforts, many local and regional initiatives aim to restore degraded European forest ecosystems. These include projects to restore peatlands and wetlands, promote agroforestry and other sustainable land use practices, and engage local communities in forest restoration and conservation.

Forest monitoring is essential for tracking the state of forests, assessing their health, and evaluating the effectiveness of policies related to their management. In the case of European forests, a monitoring framework is necessary because of the increasing impacts of climate change and pollution and the growing demand for forest resources. Early detection of and rapid response to pest and disease outbreaks (to prevent the introduction and spread of invasive species) are critical to maintaining the health and productivity of European forests.

The recently developed Forest Information System for Europe (FISE) platform provides comprehensive forest information at a European scale. This platform will provide valuable insights into the current state of European forests and support decision-making on policies related to forestry management. FISE offers user-friendly and fast access to harmonised, up-to-date, and spatially and temporally representative data on the state of and trends in forests. As a result, it can enable policymakers to make informed decisions based on reliable information. With an upgraded version of FISE, policymakers can assess the impacts of forest-related policies and evaluate their effectiveness.

References

Krüger, I. et al., 2020, Increased evidence of nutrient imbalances in forest trees across Europe, ICP Forests Brief No 4, Programme Co-ordinating Centre of ICP Forests, Thünen Institute of Forest Ecosystems (<https://doi.org/10.3220/ICP1597824383000>).

Maes, J., et al., 2020, Mapping and assessment of ecosystems and their services: an EU ecosystem assessment, Publications Office of the European Union, Luxembourg

Publications

(<https://publications.jrc.ec.europa.eu/repository/handle/JRC120383>).

Patacca, M., et al., 2023, 'Significant increase in natural disturbance impacts on European forests since 1950', *Global Change Biology* 29(5), pp. 1359-1376.

Potočić, N., et al., 2021, Tree health is deteriorating in the European forests, ICP Forests Brief No 5, Programme Co-ordinating Centre of ICP Forests, Thünen Institute of Forest Ecosystems (<https://doi.org/10.3220/ICP1638780772000>).

Senf, C., et al., 2021, 'Increasing canopy mortality affects the future demographic structure of Europe's forests', *One Earth* 4(5), pp. 749-755.

Identifiers

Briefing no. 04/2023

Title: **How are European forest ecosystems doing?**

EN HTML: TH-AM-23-004-EN-Q - ISBN: 978-92-9480-549-2 - ISSN: 2467-3196 - doi: 10.2800/40840

EN PDF: TH-AM-23-004-EN-N - ISBN: 978-92-9480-550-8 - ISSN: 2467-3196 - doi: 10.2800/840332

Published on 21 Mar 2023