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Securing the forest carbon sink for the European Union's climate ambition
Migliavacca et al., Nature 2025

The European Union's climate strategy relies heavily on forests, which cover about 40% of its land area and have historically absorbed around 10% of annual greenhouse gas emissions. However, the capacity of forests to act as a carbon sink is declining rapidly, raising concerns for the EU's 2030 and 2050 climate neutrality goals. Between 2010–2014 and 2020–2022, forest carbon uptake fell by nearly one-third, a trend mirrored across many Member States. Projections suggest that without intervention, the EU will increasingly fall short of its targets.

The decline in the forest sink is driven by multiple factors. Rising harvest rates, often linked to growing wood demand and bioenergy, reduce long-term carbon storage. At the same time, climate-driven disturbances such as droughts, storms, fires, pest outbreaks, and widespread tree mortality weaken forest resilience. The combination of these pressures diminishes forest productivity and amplifies risks of sink saturation. Forest soils, which store enormous amounts of carbon, add further uncertainty because their response to management, mortality, and extreme events remains poorly understood.

EU policy frameworks such as the LULUCF regulation, the European Green Deal, and the Nature Restoration Regulation set ambitious climate and biodiversity objectives. Yet, the weakening carbon sink threatens these commitments. To address this, the authors call for urgent, coordinated monitoring of forest resources across Europe. Advances in Earth observation, including Copernicus satellites, LiDAR, drones, and AI-driven analysis, can provide transformative insights. When combined with ground-based forest inventories, disturbance databases, and citizen science, these tools enable timely, continent-wide assessments. However, greater transparency, open data sharing, and standardized approaches are needed to ensure accountability and usability for policy.

The article highlights the need to improve mapping of disturbances and tree mortality within the next three years, alongside scalable monitoring of biodiversity and biomass changes. Biodiversity-friendly afforestation and tree planting strategies, especially those that enhance structural and species diversity, are emphasized as pathways to strengthen resilience and long-term carbon storage. Sustainable forest management, oriented beyond wood production, must balance harvest intensity with goals for permanence, biodiversity, and climate adaptation. Yet trade-offs remain: policies promoting bioenergy may undermine carbon sink capacity, while afforestation may have unintended consequences for water availability and albedo.

The modelling community faces an urgent task to refine predictions of forest carbon dynamics under climate extremes. Hybrid modelling that blends process-based approaches with data-driven AI, as well as digital twin systems, is identified as a promising avenue to provide reliable short- and long-term projections. High-resolution maps of afforestation suitability and systematic monitoring of soil carbon and deadwood stocks are also critical.

In the article, we argue that solutions must distinguish between controllable and uncontrollable drivers of the sink decline. Controllable drivers include harvest intensity and management choices, while uncontrollable ones stem from climate change and extreme events. By quantifying their relative roles, policymakers can make better-informed decisions. The paper proposes a research roadmap with short-, medium-, and long-term priorities to support EU policies, ranging from disturbance monitoring to biodiversity mapping and improved modelling of forest–climate feedbacks.

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In conclusion, safeguarding Europe's forests is indispensable for meeting the EU's climate neutrality ambition. The ongoing decline of the carbon sink underscores the urgency of integrating scientific advances into policy, ensuring sustainable forest management, and reinforcing forest resilience in the face of growing climate pressures.

References

Migliavacca, M., Grassi, G., Bastos, A. *et al.* Securing the forest carbon sink for the European Union's climate ambition. *Nature* 643, 1203–1213 (2025). <https://doi.org/10.1038/s41586-025-08967-3>