

Abstract

Forests are seen as key elements to achieving the carbon neutrality targeted by the EU climate strategy. Still, their capacity to store carbon is increasingly under threat due to the rapidly changing climate conditions. While the impact of global change on EU forests has been overall positive in the past, with increasing leaf area index, productivity, and biomass, the situation is rapidly shifting. The increasing exposure of EU forests to climate hazards is in fact raising the risks associated with natural disturbances, such as wildfires and pest outbreaks, which could have far-reaching and long-lasting consequences. In parallel, increasing experimental evidence from ground and satellite observations suggests that the CO₂ fertilization effect is likely to be on a declining trend. This phenomenon, combined with the raising importance of other limiting factors and the negative impacts of droughts and climate extremes, leads to declining forest growth and increased mortality.

The shift from CO₂ fertilized to climate-threatened forests in the EU has severe implications in terms of the provision of ecosystem services, land-based climate mitigation strategies and EU climate targets. To manage these transformations and foster targeted adaptation measures, advancements in monitoring are required to identify and respond to emerging risks more effectively and timely. In parallel, better modelling tools able to assimilate observations in a process-oriented framework are needed to forecast the potential impacts of climate change, test alternative strategies, and protect the valuable ecosystem services provided by forests while meeting the EU's ambitious climate targets.