European Commission

EU Science Hub

NEWS ANNOUNCEMENT | 13 July 2022 | Joint Research Centre

Climate variability drives global decline of forest resilience

Understanding the underlying mechanisms of forest resilience is of paramount importance to develop sound conservation and management plans.

Tree mortality in the Italian Alps driven by windstorms and bark-beetle infestations
© Alessandro Cescatti

Forests cover nearly a third of the Earth's land surface. They not only play a fundamental role in the global carbon cycle absorbing a third of anthropogenic carbon emissions and mitigating climate change, but also provide a series of ecosystem services that contribute to societal well-being, such as regulation of water flows, protection of soils and conservation of biodiversity.

The persistence and functionality of forest ecosystems are highly dependent on their capacity to withstand and recover from natural and anthropogenic perturbations. This capacity is defined as their resilience. Experimental evidence of sudden increases in tree mortality across different biomes throughout much of the Americas and in Europe is raising concerns about variation in forest resilience, yet not enough is known about how it is evolving in response to climate change.

In a new study led by JRC and published in Nature *(https://www.nature.com/articles/s41586-022-04959-9)*, researchers have integrated satellite-based vegetation indices with machine learning techniques to show how forest resilience has changed within the timeframe from 2000 to 2020.

Results show that the resilience of tropical, arid and temperate forests has declined over this period. These changes are associated with reduced water availability and increasing climate variability. By contrast, boreal forests show divergent local patterns with an average increasing trend in resilience, probably benefitting from warming and CO2 fertilisation, which may at present still override the adverse effects of climate change. These patterns emerge consistently in both managed and intact forests, corroborating the existence of common large-scale climate drivers.

The authors estimate that, overall, around 23% of intact undisturbed forests may have already reached a critical threshold, with resilience continuing to decline. This decline could have critical consequences for the key ecosystem services that forests offer, such as carbon storage. Observed trends in forest resilience should be taken into consideration in the design of land-based mitigation and adaptation plans as well as conservation and restoration activities.

Details

Publication date	13 July 2022
Author	Joint Research Centre

Related links

EU-Trees4F, a dataset on the future distribution of European tree species 2022Scientific articles and academic literatureEnvironment and climate change *(https://publications.jrc.ec.europa.eu/repository/handle/JRC127314)*

Mapping and assessment of primary and old-growth forests in Europe 2021Science for policyEnvironment and climate change *(https://publications.jrc.ec.europa.eu/repository/handle/JRC124671)*

Brief on the role of the forest-based bioeconomy in mitigating climate change through carbon storage and material substitution *(https://publications.jrc.ec.europa.eu/repository/handle/JRC124374)*

Tree species distribution data and maps for Europe *(https://publications.jrc.ec.europa.eu/repository/handle/JRC117438)*