Diverse forests are best at standing up to storms, modeling study finds

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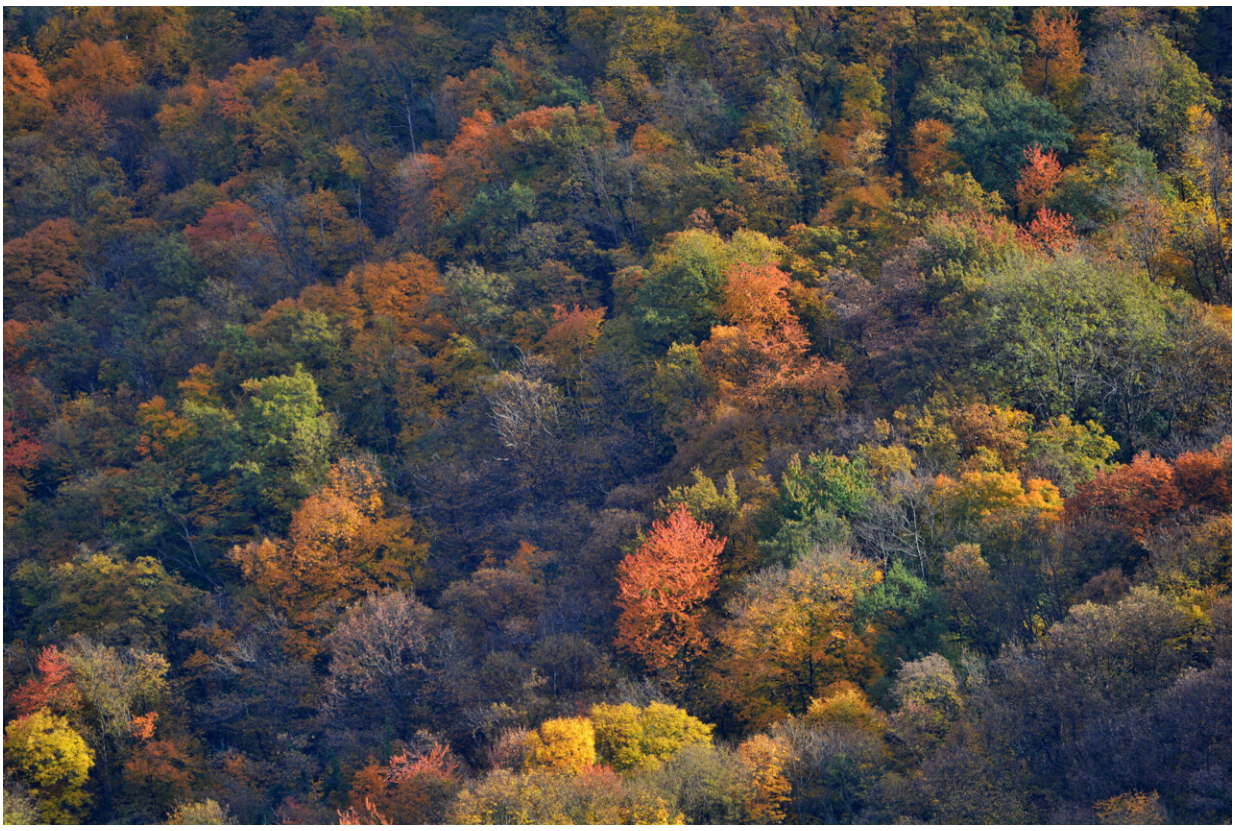
Mixed forest stand in Solböle, Southern Finland, hosting both broadleaf and conifer species. Credit: J. Barrere

European forests with a greater diversity of tree species are more resilient to storms, according to new research published in the journal *Functional Ecology*.

A new study by researchers at the French National Research Institute for Agriculture, Food and Environment (INRAE) reveals that in Europe, the forests that are most resilient to storms are those with a greater diversity of tree species and dominated by slow growing species with high wood density, like oaks.

The researchers also found that the positive effect of tree diversity on storm resistance was more pronounced under extreme climatic conditions, such as the hot–dry conditions of the Mediterranean region and the cold–wet conditions of northern Scandinavia.



Belledone, a Mountain forest in autumn. Credit: G. Loucougary

The study used simulations to model how forests with different characteristics, such as tree species diversity, resist and recover from storm damage.

In recent decades, Europe has experienced more frequent and severe windstorms that put forests and the ecosystem services they provide, such as habitat, carbon storage and timber, at risk. The researchers say their findings can aid in predicting the impact of increased storm frequency and intensity on forests and point to how we can make forests more resilient.

Dr. Julien Barrere, researcher at INRAE and lead author of the study said, "An important takeaway from our study is that monocultures of fast growing species such as pine, although valuable from an economic point of view, are more susceptible to storm damage. In a context of increasing storm losses across the continent, our study therefore argues for forest management practices that promote diversity and slow growing tree species such as oak."

Forested landscape at the tree line in the Belledone mountain range of the French Alps. Credit: J. Barrere

In the study, the researchers created a model to simulate the dynamics of hundreds of forests after a storm, calibrating the model with data from 91,528 real-life forest plots in Europe. "Our simulated forests varied in both climate conditions, ranging from Mediterranean to Boreal, and in composition, i.e., in tree species diversity and identity," explained Dr. Barrere. "This allowed us to quantify the relationship between forest composition and resilience to storm disturbance, and how this relationship changes along the European climatic gradient."

The researchers caution that because this is a modeling study, fieldwork is still needed to support the findings. Dr. Barrere said, "Although modeling studies like ours are essential for drawing conclusions about forest dynamics due to the long timescales in nature, the results must be interpreted with a clear understanding of the model hypotheses and complemented by field studies."

More information: Forest storm resilience depends on the interplay between functional composition and climate—Insights from European-scale simulations, *Functional Ecology* (2024). DOI: 10.1111/1365-2435.14489

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