

Tree ring records reveal climate-driven drought shifts across Europe and Asia

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Rising global temperatures are likely contributing to drought conditions in the 21st century, including the 2017 drought in Lago della Duchessa in Italy, pictured here. Credit: Pamela Trisolino, EGU, CC BY-NC-ND 3.0

Determining the degree to which shifting drought conditions around the world are attributable to natural hydroclimatic variability and how much

they are caused by climate change is a complicated task. Scientists often use complex computer models to simulate past climate variability and to identify unprecedented drought conditions.

These models can also help identify the factors, such as temperature, precipitation, and changes in land use, that drive such conditions. However, they can also exhibit biases that may affect the credibility of drought estimates in some regions.

Because tree rings tend to grow wider in warmer, wetter years and thinner in drier, colder years, they act as a record of natural climate variability and offer a complementary approach to model-based hydroclimate reconstruction.

To study drought across Europe and Asia, Kate Marvel and colleagues turned to tree ring measurements, using the new Great Eurasian Drought Atlas (GEDA), which includes records from thousands of individual trees that grew between 1000 and 2020 CE. The study is [published](#) in the journal *AGU Advances*.

The team divided the GEDA data among the same land regions as defined in the Intergovernmental Panel on Climate Change's Sixth Assessment Report. Using tree ring measurements from 1000 to 1849, they estimated preindustrial variations in the average Palmer drought severity index (PDSI)—a common measurement of drought risk—for each region. They then assessed whether these preindustrial variations could explain modern (1850–2020) PDSI values.

The researchers found that in many regions, modern PDSI changes could be more accurately explained by rising global temperatures, suggesting that 21st-century [drought conditions](#) are unlikely to have arisen from natural variability alone. The findings indicate that eastern Europe, the Mediterranean, and Arctic Russia are each growing drier as the climate

warms, whereas northern Europe, east central Asia, and Tibet are growing wetter.

The researchers note that [tree rings](#) can be affected by factors other than climate variation. However, these factors are unlikely to have significantly affected their results, as databases such as GEDA usually include data from selectively sampled locations and [tree species](#) for which climate is the main factor affecting tree ring growth.

More information: Kate Marvel et al, Global Warming Is Likely Affecting Regional Drought Across Eurasia, *AGU Advances* (2025). [DOI: 10.1029/2024AV001289](https://doi.org/10.1029/2024AV001289)

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