

Tree rings reveal that it has not been this warm in the past 1,200 years

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The researchers included subfossil wood from trees preserved in mountain lakes.
Credit: Håkan Grudd

A new 1,200 year-long time series based on tree rings shows that the current warming is unprecedented during this period. This is reported by researchers from the Swiss Federal Institute for Forest, Snow and Landscape Research WSL in the scientific journal *Nature*.

The Middle Ages and the centuries that followed were not only turbulent socially, but also climatically. Not only was there a "Little Ice Age," but also its opposite: the "Medieval climate anomaly," during which it may have been unusually warm. The latter can clearly be seen in reconstructed temperatures from annual [tree rings](#). In fact, reconstructed Medieval temperatures are often portrayed as higher than today's temperatures.

This has long been a puzzle because there is no known physical explanation for such exceptional Medieval warmth. Climate models are therefore unable to simulate it and instead show only moderately warm temperatures for the Medieval climate anomaly.

Support for climate models

"Previous reconstructions are based on the width or density of the annual tree rings," explains Georg von Arx from the Swiss Federal Institute for Forest, Snow and Landscape Research WSL. "Both are very much dependent on [temperature](#), but sometimes other factors play a role in how wide or dense a tree ring gets."

Together with other researchers, the head of the Dendrosciences research group has created a new reconstruction based on a particularly precise method to extract temperature information from trees. In contrast to previous work, the new results lead to the same conclusion as the climate models: the Medieval climate anomaly was cooler than previously thought, at least in Scandinavia, where the wood studied originated. Today's warming is thus likely outside the range of natural

fluctuations in temperatures over the past 1,200 years, the researchers conclude.

50 million cells measured

For their study they used a new method optimized at WSL to directly measure the cell wall thickness of the wood cells in the annual tree rings. "Each individual cell in each tree ring records climatic information under which it was formed. By analyzing hundreds, sometimes thousands of cells per ring, extraordinary pure climate information can be obtained," explains the first author of the study and WSL researcher Jesper Björklund.

For their new time series, the researchers measured the cell walls of 50 million cells. These come from 188 living and dead Swedish and Finnish Scots pines (*Pinus sylvestris*), whose annual rings together cover a period of 1,170 years. Based on these measurements, the researchers then reconstructed the [summer temperatures](#) in this region and compared them both with [model](#) simulations of the regional climate and with previous reconstructions based on the density of the annual rings.

Unprecedented warming

The result was clear: the temperatures of the models and the new time series align. "This means that there are now two independent accounts of the regional climate that both find lower temperatures during the Medieval, providing new evidence that this phase was not as warm as previously thought," says Björklund. "Instead, both show that the current warming is unprecedented, at least in the past millennium, and emphasize the role of greenhouse gas emissions on Scandinavian temperature variability."

The previous reconstructions based on tree [ring](#) density, in contrast,

indicated significantly higher temperatures for the Medieval climate anomaly and [lower temperatures](#) for the current warming. "This is critical because such reconstructions are considered when evaluating the accuracy of [climate models](#). If the previous reconstructions were used as a benchmark, this would significantly downplay the [human influence](#) on current [climate](#) warming and reduce confidence in model projections," says von Arx.

More information: Jesper Björklund et al, Fennoscandian tree-ring anatomy shows a warmer modern than medieval climate, *Nature* (2023). [DOI: 10.1038/s41586-023-06176-4](https://doi.org/10.1038/s41586-023-06176-4)

Provided by Swiss Federal Institute for Forest, Snow and Landscape Research WSL

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