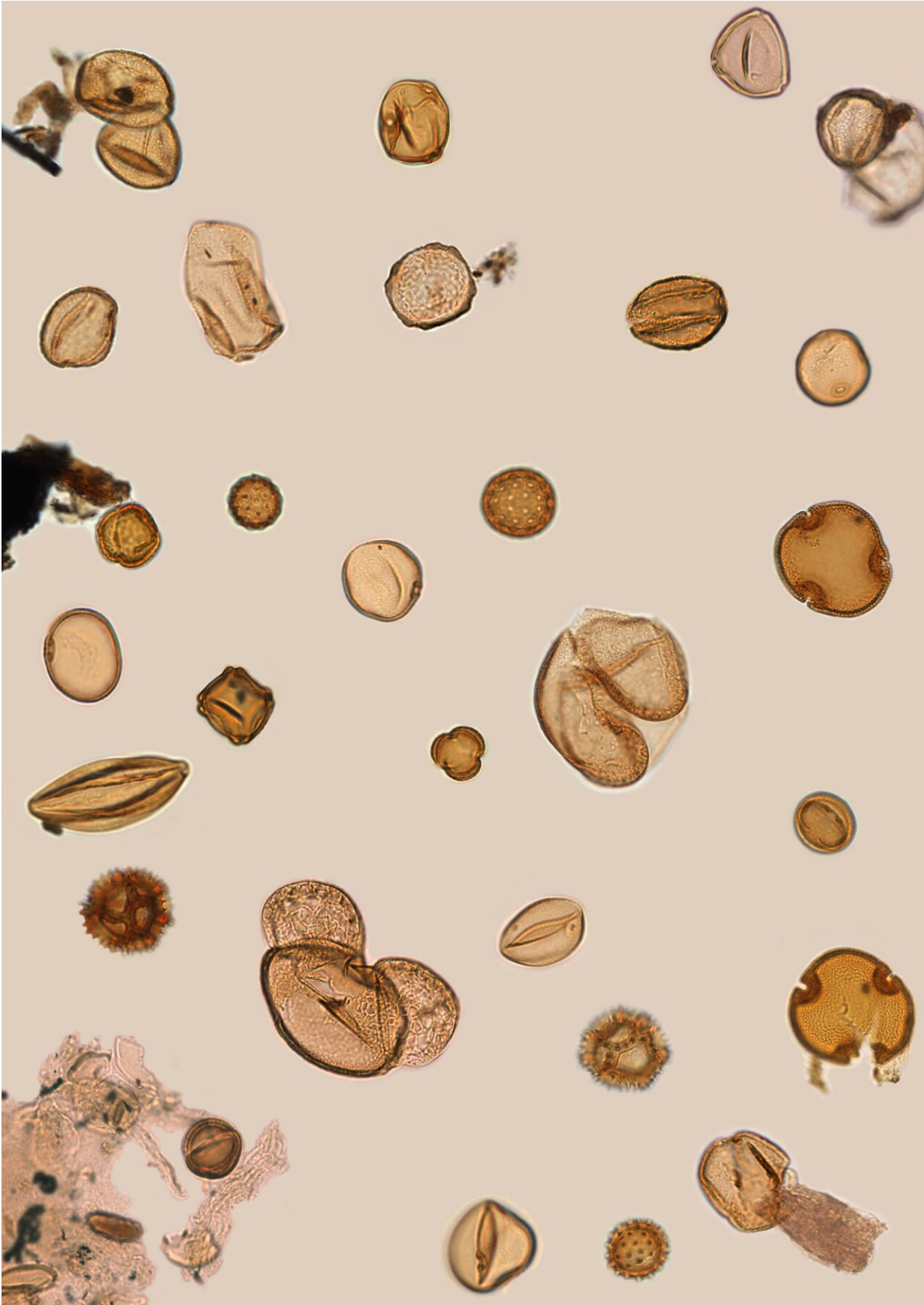


Progressive climate change: Desertification threatens Mediterranean forests

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Approx. 400,000-year-old pollen grains from Tenaghi Philippon. Due to their good preservability, they remain intact in drill cores, making it possible to reconstruct vegetation and climate changes in the geological past. Credit: Ulrich Kotthoff

With a view toward predicting the consequences of human-made climate change for Mediterranean ecosystems, Earth scientists from Heidelberg University have studied natural climate and vegetation fluctuations of the past 500,000 years. Their primary focus was the effects of these fluctuations on the forests in the Mediterranean region.

To this end, researchers led by Dr. Andreas Koutsodendris analyzed [fossil pollen](#) preserved in a sediment core from Greece. Their investigations suggest that in long-standing drought conditions—as the latest climate models predict—desertification of the forests in the Mediterranean region is likely in the near future. The work is published in the journal *Nature Communications*.

Mediterranean forests are not only hotspots of biodiversity, but they also provide critical ecosystem services. They protect against [soil erosion](#), regulate the regional climate and hydrological conditions, and supply food and timber. "Because they are exceptionally sensitive to [climate change](#), concern for their survival is growing in light of anthropogenic CO₂ emissions and associated global warming," explains Dr. Koutsodendris. He is a member of the research group of Prof. Dr. Jörg Pross, which investigates the Earth's environmental and ecosystem dynamics at Heidelberg University's Institute of Earth Sciences.

To trace how Mediterranean forests reacted to climate changes in the

past, the Heidelberg researchers, in cooperation with colleagues from France, Germany, Greece, and the United Kingdom, took drill cores from Tenaghi Philippon—a terrestrial climate archive in the northeast of Greece—that provide a complete record of the past 500,000 years, and in which fossil pollen grains are preserved.

The data on vegetation development in this period gained from the pollen grains was correlated with geochemical data on contemporaneous fluctuations in precipitation. The results of the team led by Dr. Koutsodendris show that, in the past, the Mediterranean forests transformed into steppes within a few decades as soon as specific precipitation thresholds were crossed.

Using ecological models, the scientists also examined possible factors that caused precipitation patterns to change. Their analyses show that changes in atmospheric CO₂ content influence the amount of precipitation in the Mediterranean region.

"In the past, a decrease in rainfall of 40% to 45% was sufficient to set off a sudden shift from forest to steppe biomes under [natural conditions](#)," explains Dr. Koutsodendris. These results imply that such a shift could lie ahead for the forests of the Mediterranean region in the near future if nothing is done to protect them, the Heidelberg Earth scientist says.

More information: Andreas Koutsodendris et al, Atmospheric CO₂ forcing on Mediterranean biomes during the past 500 kyrs, *Nature Communications* (2023). [DOI: 10.1038/s41467-023-37388-x](https://doi.org/10.1038/s41467-023-37388-x)

Provided by Heidelberg University

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