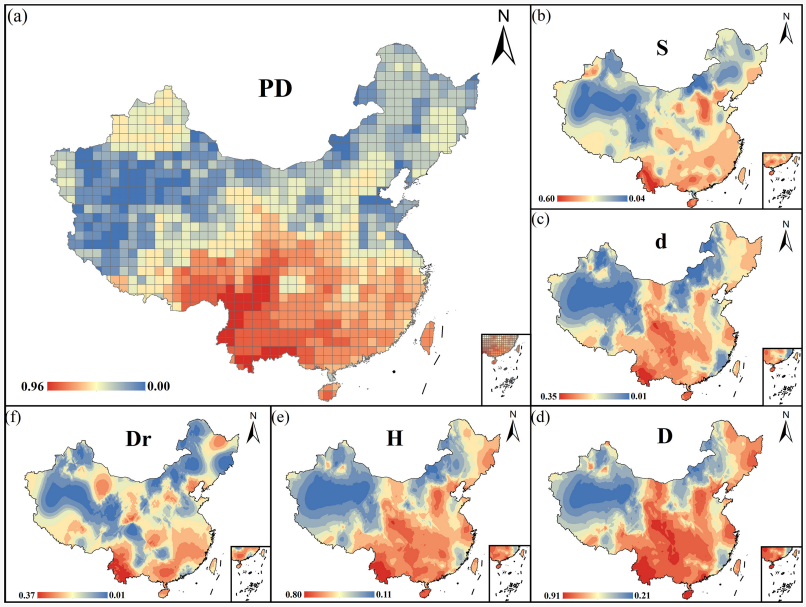
Climate Change and Human Activity Threaten Plant Diversity—Can Ancient Pollen Help Predict the Future?

GA, UNITED STATES, April 15, 2025 /EINPresswire.com/ -- Scientists from the Institute of Tibetan Plateau Research, Chinese Academy of Sciences (CAS) have compared several methods for plant diversity reconstruction using pollen data. By analyzing modern pollen distributions across China, the team calculated angiosperm diversity using five key ecological indices and—for the first time—applied an image similarity algorithm (SSIM) to validate their findings. Their work not only identifies the most reliable indicators for tracking biodiversity changes but also reveals how climate factors, particularly winter temperatures, shape plant distributions—a critical insight for conservation in the face of climate change.



Maps of spatial patterns of angiosperm diversity (PD (a), adapted from (Lu et al., 2018)) versus palynological diversity indices S (b), d (c), Dr (d), H (e), D (f). SSIM, the structural similarity index measure. Https://doi.org/10.1016/j.pld.2025.01.004

The world is experiencing its sixth mass extinction, driven by global warming and human activities. According to Prof Xiaomin Fang from the Institute of Tibetan Plateau Research, Chinese Academy of Sciences (CAS), in China, over 10% of China's vascular plant species are now threatened. To protect modern biodiversity, a deeper understanding of evolutionary history and geological records is imperative.

Traditional studies on ancient plant diversity, however, rely on fossilized leaves and stems, and these records are often fragmented due to preservation biases. Prof Fuli Wu, a Cenozoic palynology expert, explains. "Plant spores and pollen offer a solution—they are abundant, well-preserved, and can fill gaps left by macrofossils."

In a new study that brought together the two experts and a team of researchers in China, modern pollen data were analyzed with biodiversity indices applied to reconstruct angiosperm diversity patterns across China. Lead author Dr Yuxuan Jiang standardized pollen-derived diversity metrics and compared them to modern plant distributions using the structural similarity index measure (SSIM), a novel approach in palynology.

"Our results show that the Shannon-Wiener index (H) and the Berger-Parker index (d) indices most closely matched modern diversity patterns, making them optimal tools for reconstructing past biodiversity. Moreover, we found climate strongly influenced diversity, with coldest –month temperatures being the dominant factor, followed by annual precipitation," shares Jiang.

"Our work highlights the importance of winter temperatures in shaping plant biodiversity," adds Wu, "This insight should guide conservation strategies, particularly under climate change."

The study, published in KeAi's Plant Diversity, paves the way for tracking plant diversity evolution through pollen records, offering a scientific basis for predicting and protecting biodiversity in a warming world with increasing extreme events.

References
DOI
10.1016/j.pld.2025.01.004

Original Source URL
https://doi.org/10.1016/j.pld.2025.01.004

Funding information
This research was co-supported by the National Key Research and Development Program of China (2022YFF0800800), the National Natural Science Foundation of China (41988101-01, 42130205) and the Second Tibetan Plateau Scientific Expedition and Research Program (2019QZKK0707).

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