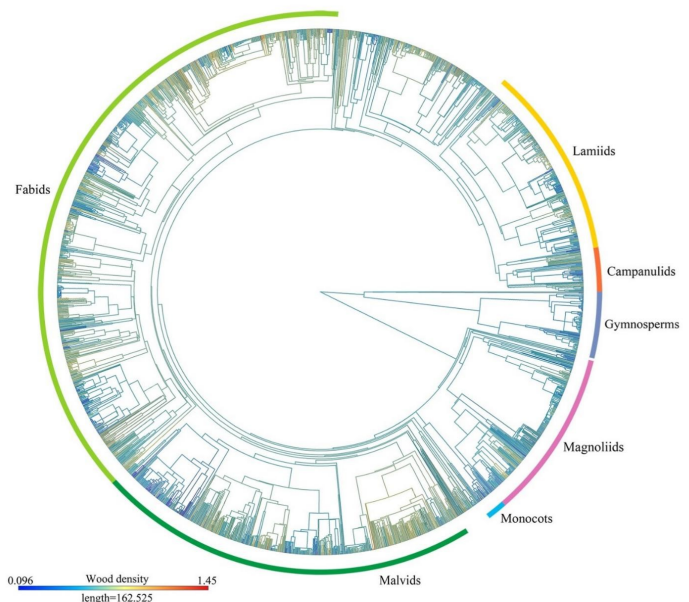


Evolutionary history shapes variation of wood density

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-- • Using a comprehensive global dataset including 27,297 measurements of [wood density](#) from 2,621 tree species worldwide, we test the hypothesis that the legacy of evolutionary history plays an important role in driving the variation of wood density among tree species.

- Wood density exhibited a significant and relatively strong phylogenetic signal.
- Evolutionary history, consisting of both phylogeny and species, largely outperformed present-day environmental conditions in explaining global wood density variation.
- Wood density showed significant biogeographical patterns at the global scale and varied remarkably across different biomes.



Phylogenetic tree of wood density for 2,621 species investigated in this study.

Ecology and evolutionary biology suggest that closely related species are more likely to exhibit morphological and functional similarities compared to distantly related species. Each tree species represents a unique genetic reservoir and is a product of long-term evolutionary processes, with specific morphological structures and functional traits. However, previous studies have overlooked the relationship between the allometric biomass and wood density and phylogeny.

To that end, our study utilized a comprehensive global dataset to show that phylogeny plays a significant role in shaping wood density patterns. We assessed phylogenetic signal in different taxonomic (e.g., angiosperms and gymnosperms) and ecological (e.g., tropical, temperate, and boreal) groups of tree species, explored the biogeographical and phylogenetic patterns of wood density, and quantified the relative importance of current environmental factors (e.g., climatic

and soil variables) and evolutionary history (i.e., phylogenetic relatedness among species and lineages) in driving global wood density variation.

We found that wood density displayed a significant phylogenetic signal. Notably, wood density differed among different biomes and climatic zones, with higher mean values of wood density in relatively drier regions (highest in subtropical desert).

Our study (<https://doi.org/10.1016/j.pld.2024.04.002>), published in the KeAi journal Plant Diversity, revealed that at a global scale, for angiosperms and gymnosperms combined, phylogeny and species (representing the variance explained by taxonomy and not direct explained by long-term evolution process) accounted for 84.3% and 7.7% of total wood density variation, respectively. In contrast, current environmental factors accounted for only 2.7% of total wood density variation. When analyzing angiosperms and gymnosperms separately, the breakdown of explained variation differed: 84.2%, 7.5% and 6.7% for angiosperms, and 45.7%, 21.3% and 18.6% for gymnosperms.

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