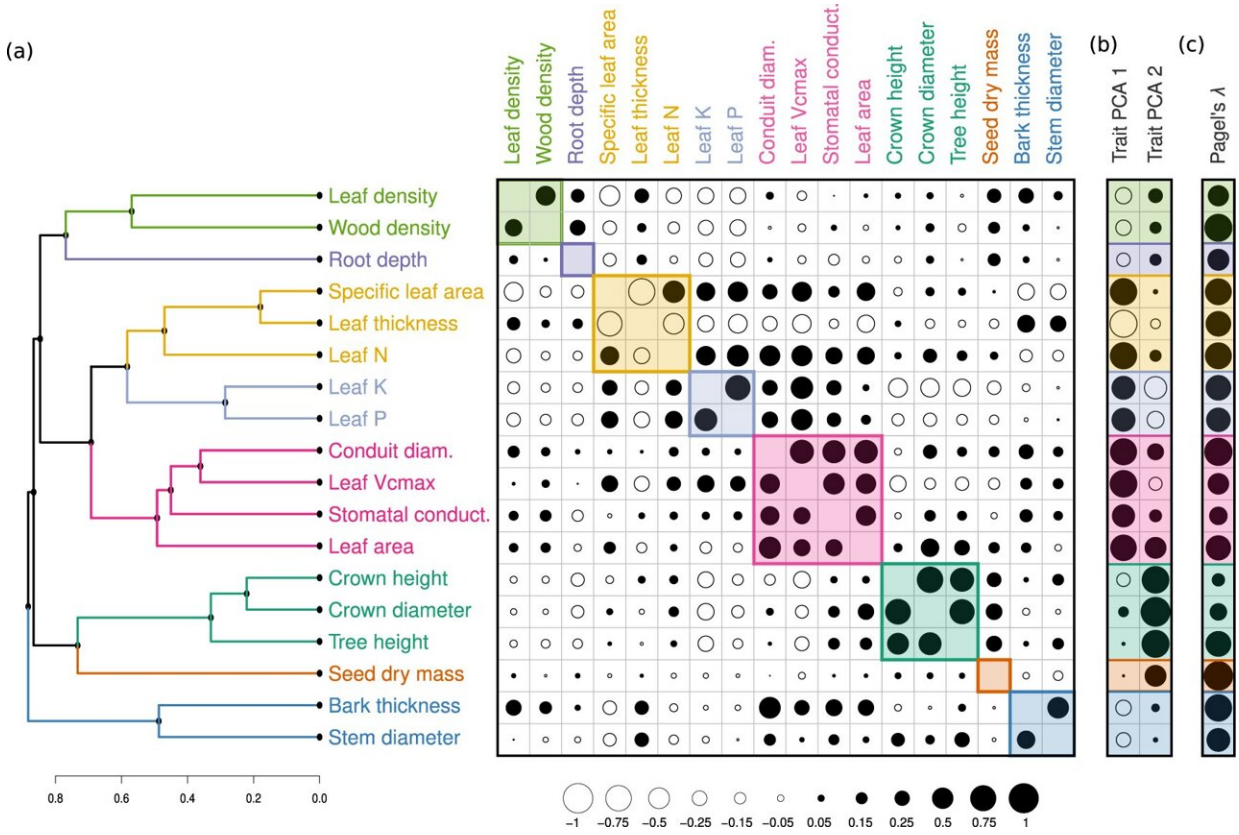
How tree species adapt to climate change

June 14 2022



Trait correlations and functional clusters. a Trait clusters with high average intra-group correlation. The upper triangle gives the species-weighted correlations incorporating intraspecific variation. The lower triangle gives the corresponding correlations among phylogenetic independent contrasts, which adjusts for pseudo-replication due to the non-independence of closely related species. The size of the circle denotes the relative strength of the correlation, with solid circles denoting positive correlations and open circles denoting negative correlations (see Supplementary Fig. 19 for the numeric values). b PC loadings for each trait and each of the first two principal component axes, illustrating which functional trait clusters align most strongly with the dominant axes of trait variation (see

Supplementary Table 5 for the full set of PC loadings). c The species-level phylogenetic signal of each trait (Pagel's λ), calculated using only the raw trait values. Credit: *Nature Communications* (2022). DOI: 10.1038/s41467-022-30888-2

Can trees adapt to (climate) change? Which trees are more or less capable of doing so, and why? A group of researchers from all over the world set to work on these questions. Professor of Environmental Biology Peter van Bodegom helped to classify the functional traits of tree species, including, for example, the thickness of the bark, the height of the trunk and the construction of the leaf. Thanks to a statistical analysis of the characteristics of 50,000 tree species, researchers can now see which characteristics vary together. The results have been published in the journal *Nature Communications*.

To determine which characteristics of tree species often occur together and what this implies, about 30 scientists from 16 different countries worked together. Researchers in Brazil, the Netherlands, Austria, Switzerland and even Russia and New Zealand classified the traits of tree species. The focus was on eighteen functional traits, including leaf, seed, bark, wood, crown and root properties. On this basis, the researchers created the largest database in the world containing 50,000 tree species.

Van Bodegom also supplied data for the extensive database and contributed to the development of the analytical methodology. "We based the database on the field measurements of a large network of researchers. They have measured the properties of tree species in fields and forests using similar protocols. Everything is stored in a central database. Then we analyzed that database statistically to identify patterns in the traits."

Cluster of traits that occur together

From this analysis, the researchers can see which traits of trees often occur together and how these traits influence each other. From this, the researchers identified eight different clusters. Each cluster reflects a unique aspect of the tree's shape and function. "For example, we see a cluster of properties that all have to do with how the tree deals with water or light. In the light cluster, for example, the height of the tree and the diameter of the crown are an important set of properties that are related."

Besides the obvious result that coniferous (or needle-bearing) trees behave differently from deciduous trees, it also shows which clusters of traits often come together. "Some of these clusters had never been demonstrated on a global scale before. This shows, for example, that in addition to competition for light, adaptation to drought and fire are also very important traits."

Resistance to climate change

These results are important in the context of climate change. "It shows that some tree species are much better adapted to drought and the increasing number of forest fires. The fact that one species is more resistant than another can lead to all kinds of shifts in the diversity and location of the species. Thanks to the classification of all these characteristics, we can predict which trees are more or less capable of adapting to (climate) change."

Better resistance to forest fires

Resistance to forest fires, for example, depends on the amount of bark a tree species has. As climate change will lead to more forest fires, tree

species that are adapted to the heat have an advantage. The same applies to trees that can withstand drought.

Van Bodegom is very satisfied with the results of the study. "I find these clusters so interesting because they are much more detailed than previous global analyses. The study gives a much better understanding of how trees function around the world and how they differ."

More information: Daniel S. Maynard et al, Global relationships in tree functional traits, *Nature Communications* (2022). DOI: 10.1038/s41467-022-30888-2

Provided by Leiden University

Citation: How tree species adapt to climate change (2022, June 14) retrieved 23 June 2024 from https://phys.org/news/2022-06-tree-species-climate.html

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