Trees employ similar strategies to outcompete their neighbors

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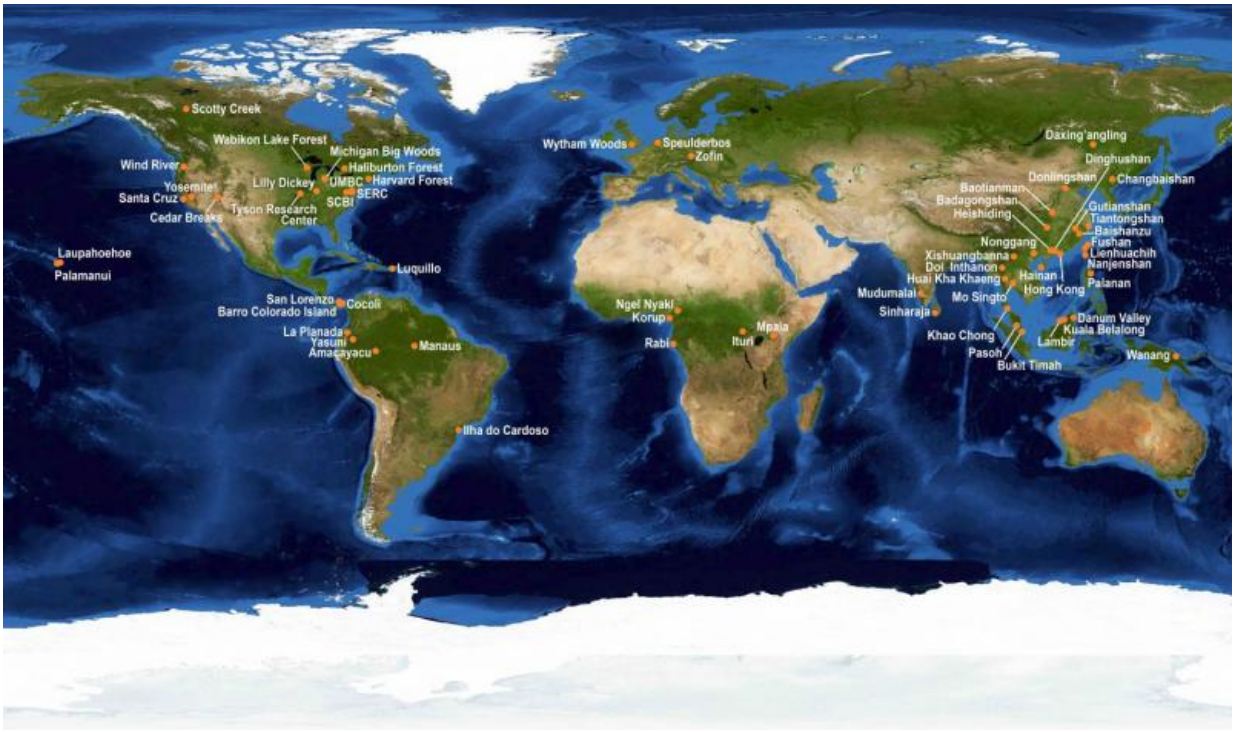

By studying forests in the same way at sites around the world, the Smithsonian ForestGEO network provides some of the best on-the-ground data to understand forests and their responses to global change. Credit: STRI

How more than 1,000 tree species may occur in a small area of forest in Amazonia or Borneo is an unsolved mystery. Their ability to co-exist may depend on how trees get along with their neighbors. A new study

based, in part, on data from the Smithsonian's Forest Global Earth Observatory (ForestGEO) network shows that trees worldwide compete in some of the same ways, making simpler models of forest response to climate change possible.

Published in *Nature*, the study demonstrated how 'personal' traits such as wood density and leaf morphology influence a tree species' ability to compete. There are trade-offs. Species with lighter wood usually grow more quickly than species with denser wood. But species with lighter wood also tend to die sooner and be poor competitors. Trees with dense tissues have more impact on their neighbors.

"We uncovered straightforward relationships between tree shape, growth rates and competitive abilities that organize tree communities around the world," said S. Joseph Wright, co-author and staff scientist at the Smithsonian Tropical Research Institute in Panama.

Size, growth rate, wood density and other personal traits that characterized individual tree species are useful when it comes to understanding how many different species compete as they coexist in tropical forests Credit: Sean Mattson, Smithsonian Tropical Research Institute

Tree-to-tree interactions are difficult to study because trees grow slowly and are long-lived. Lead author Georges Kunstler of the Institut National de Recherche en Sciences et Technologies pour l'Environnement et l'Agriculture in France and colleagues used data from 3 million trees of 2,500 species growing at 140,000 sites from all forested biomes, to determine how traits influence tree competition. The study incorporated data from ForestGEO plots, coordinated by the Center for Tropical Forest Science at the Smithsonian Tropical Research Institute, including forest data from Barro Colorado Island, Panama; Luquillo, Puerto Rico;

and Fushan, Taiwan.

Their findings strongly support a long-standing ecological idea about how forest succession influences tree diversity. In young forests, trees are more spread out, giving fast-growing species an advantage when there is little competition from surrounding trees. But as a forest matures and neighbors become more abundant, slower-growing trees win out because they are better competitors for resources like minerals, water and light.One of the most prominent ideas about how forest diversity is maintained is that trees can avoid competition by being different from their neighbors in the way they use resources and their life-history strategy. If this were the case, any trait could be advantageous as long as it was different from those of neighboring trees. Instead, this study shows that certain traits are more advantageous at different stages of forest succession whether or not they differ from those of neighbors.

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