The secret to life in the tropics

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One notable pattern in global biodiversity is the difference in species diversity between tropical and temperate latitudes. Places, such as the Philippines, with tropical climates tend to have much higher biodiversity than places, such as the northern parts of Europe and America, with temperate climates. Explanations have been offered for why this difference came about; many of them are predicated on the geological and biological conditions from millions of years ago.

However, fewer theories have been formulated about why this difference has been maintained over an extremely long period, especially as conditions have changed drastically since then.

To help figure this out, a worldwide team of scientists led by researchers at Washington University in St. Louis, in the United States, came together. Because these scientists wanted to study a global pattern, they had to study all over the world. This global team included scientists from the United States, Canada, the Czech Republic, Thailand, Taiwan, Gabon, and China. As an important center of biodiversity, the Philippines was also a key part of the study.

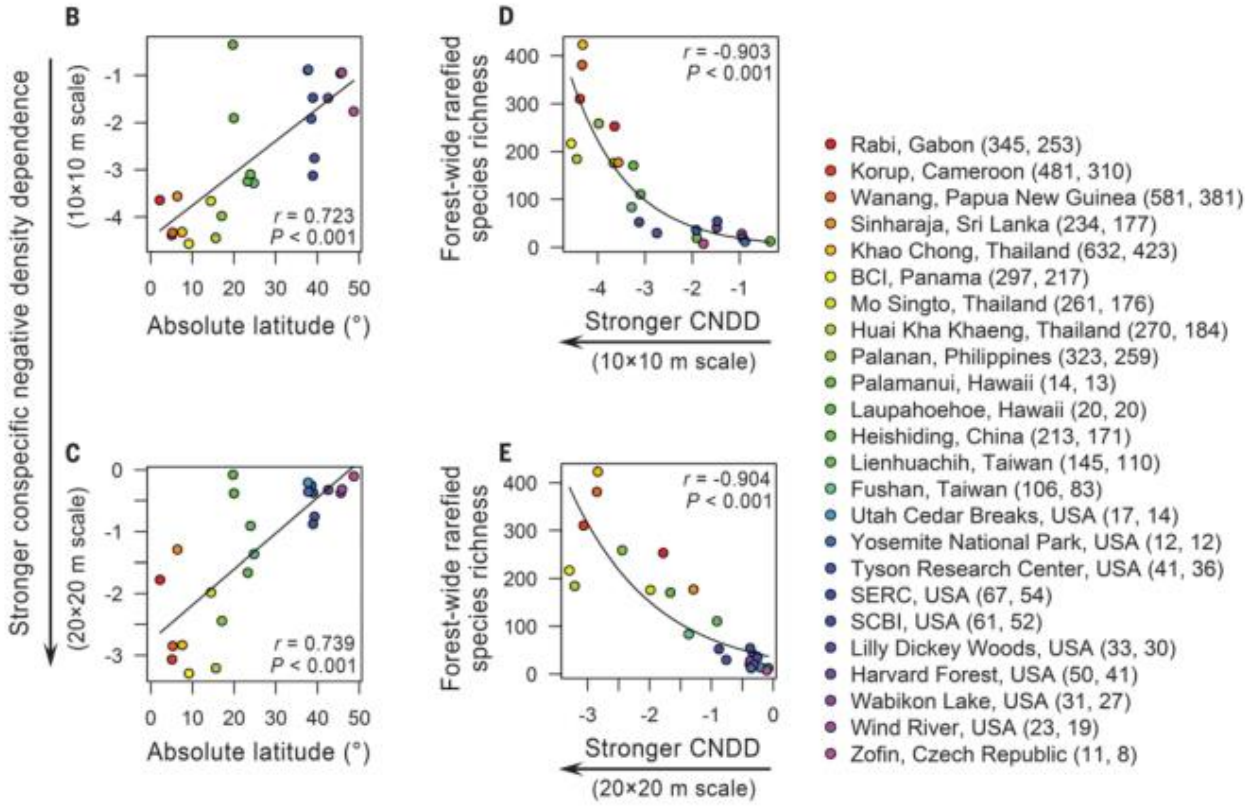
The Filipino team on this project featured scientists from the University of the Philippines and Far Eastern University. They took the lead in studying a forest in Palanan, a municipality of Isabela, and their contribution was invaluable in testing the American researchers' theory.

The theory in question is that the persistent difference in biodiversity between places in tropical and temperate latitudes is due to what is called conspecific negative density dependence (CNDD), referring to the phenomenon where the population growth of a species declines as the population of that species grows. In other words, the more individuals of a species are in a certain place, the fewer of their species make it to adulthood.

This trend can even continue until the population growth of a species is negative. This also means, however, that when a species' population is much lower, that species will start to grow faster, with a greater proportion of individuals making it into adulthood.

CNDD can be due to a number of factors. For example, as the population of a species grows, individuals will have to compete for the same limited resources, such as food and water. A greater density of individuals can also make species that parasitize that species, or hunt them for food, more effective since there are more resources for them. Similarly, when there are fewer members of that species, there are more resources for each of them, and their predators will have fewer chances to feed on them.

CNDD acts as a kind of controlling force, making sure the population of any one species does not get too large, or too small, allowing an extremely wide range of species to exist in the same place. This is what the researchers wanted to measure in forests all around the world. For this study, they focused on trees in tropical and temperate forests.



The researchers found that species richness increased as CNDD increased.

Smaller studies have been done; they have found some evidence linking CNDD to the maintenance of biodiversity and suggesting that CNDD is stronger in tropical latitudes versus temperate ones. The current study aims to reframe those studies by performing a global test of this theory and trying to find out exactly how much of an impact CNDD makes on biodiversity.

The Filipino scientists involved in this study surveyed a forest plot in Isabela, mapping, measuring, and identifying every tree over a certain size. This was to identify the number of species in the forest plot, as well as how healthy each species was, in terms of number of individuals. These data were combined with those of teams all over the world and analyzed.

Using the data, the scientists were able to quantify the strength of CNDD on the different species in each forest by looking at how the number of adult trees of each species affected the number of saplings of the same species. In species with many adults and very few saplings, CNDD was stronger, and CNDD was weaker in species with more even numbers of adults and saplings.

Using this metric, the researchers found that CNDD tended to be stronger at tropical latitudes. There are also more rare species in tropical latitudes than temperate ones, and CNDD was stronger for these rare species in tropical regions as well. This trend shows that there is indeed a stronger stabilizing effect on species—and, more important, rare species—at tropical latitudes than temperate ones.

Such a key piece of information opens up many possibilities for research into this and other global biodiversity trends. It also raises the further question of why CNDD is stronger in the tropics. The researchers gave several hypotheses, including more intense competition within species in the tropics and more difficulty for species to move around, meaning interactions between trees and diseases or parasites can become more specialized and deadlier. The study also shows the importance of the Philippines to biodiversity research, the Philippines being one of only 17 megadiverse countries in the world.

All told, 24 forests in 13 countries were studied, involving a team of 50 scientists. Their results were published in *Science*.

REFERENCE

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Luis Wilfrido Atienza graduated from the Ateneo de Manila University, with a BS in Biology, and a minor in poetry. He currently works as a copywriter for a sustainable agency, and spends some of his free time writing about science.