

Critical temperature for tropical tree lifespan revealed

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Dead tree trunk in Peru rainforest. Credit: Roel Brienen

For the first time scientists have provided clear evidence that tropical

tree lifespan decreases above a critical temperature threshold.

Findings, published today in the journal *PNAS* (*Proceedings of the National Academy of Sciences*) show that across the tropics, tree lifespans decrease for temperatures above 25 C.

As temperatures are rising rapidly across large parts of the tropics, tree mortality is likely to accelerate in substantial parts of the tropics, including the Amazon, Pantanal and Atlantic forests with implications for animal habitats, air quality and carbon stocks.

Although [tropical](#) rainforests account for only 7% of all land, they are home to about 50% of all animal and plant species, and approximately 50 % of forest carbon stocks on earth. Thus small changes in the functioning of [tropical forests](#) can significantly change the atmospheric levels of CO₂—the most important anthropogenic greenhouse gas.

Professor Manuel Gloor and Dr. Roel Brienen, of Leeds' School of Geography, are co-authors of the new study.

Professor Gloor said: "Many regions in the tropics are heating up particularly rapidly and substantial areas will become warmer, on average, than approximately 25 C.

"Our findings—which are the first to demonstrate that there is a [temperature](#) threshold—suggests that for [trees](#) in these regions, their longevity is likely to be negatively affected."

Dr. Brienen added: "This indicates that tropical forests may be more vulnerable to increasing heat than has been previously thought. As a result of global warming, we therefore expect a shortening of tree lifespans in the tropics.



Tropical rainforest in Peru. Credit: Roel Brienen

"These results are a [warning sign](#) that, along with deforestation, global warming adds extra stress on the Earth's tropical forests."

The research team, led by Dr. Giuliano Locosselli, from the Institute of Biosciences, University of São Paulo, Brazil, spent four years examining tree-ring data from more than 100,000 trees worldwide belonging to 400 different tree species from 3,000 sites across the globe.

Dr. Locosselli said: "In the tropics, trees grow, on average, twice as fast as those in cooler regions of the world. But they also have a shorter average lifespan of 186 years, compared to 322 years of trees in other climates. Our analysis suggests that the life-spans in the tropics will likely decrease further still.

"If tropical trees die earlier, this will affect how much carbon these forests can hold, raising concerns about the future potential of forests to offset CO₂ emissions from fossil fuel burning. It could also cause changes in biodiversity and a decrease in the number of species on the planet."

Currently, [average temperatures](#) in tropical rainforests vary between 21 C and 30 C. According to the latest forecasts, tropical temperatures on land will continue to rise, reaching on average a combined 2.5 C above pre-industrial levels over the next 10 to 20 years. The study also shows that temperature effects on tree longevity will be further exacerbated by dry conditions.

Climate change will also have an impact on tropical rainforests outside of South America, such as the Congo Forest in west Africa—the second largest tropical [forest](#) in the world after the Amazon.

Dr. Locosselli added: "While tropical rainforests in the Amazon are already close to this temperature threshold temperatures in the Congo are lower. But, with this great increase in temperature, we might begin to see signs of increased tree mortality. From this point of view, the scenario is quite bleak."

Professor Marcos Buckeridge, Director of the Biosciences Institute of the University of São Paulo, who is also a co-author of the study, added: "Temperatures will keep rising in the near future even if we were to take drastic emissions reductions measures.

"Thus it is unavoidable that the critical threshold for tree longevity will increasingly be exceeded in the tropics and thus it is even more important to protect tropical forests and curb greenhouse emissions."

"Global tree-ring analysis reveals rapid decrease in tropical tree longevity with temperature" is published in *PNAS (Proceedings of the National Academy of Sciences)*.

More information: Giuliano Maselli Locosselli et al., "Global tree-ring analysis reveals rapid decrease in tropical tree longevity with temperature," *PNAS* (2020).

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