Average size of trees in Amazon has increased as CO_2 levels rise

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Scientists in Colombia measuring a giant Ceiba tree. Credit: Pauline Kindler

Average tree size across the Amazon has increased by 3.2% every decade, consistent with a response to rising carbon dioxide levels, a new study suggests.

The research published in *Nature Plants* by a global team of tropical forest scientists shows that the average size of trees in Amazon forests has increased over recent decades. The team of almost a hundred researchers monitored the size of trees in 188 permanent plots and discovered that the increase has continued for at least 30 years.

The study is the result of an international partnership of more than 60 universities in South America, the UK and beyond—including the Universities of Birmingham, Bristol, and Leeds.

Co-author of the study, Professor Beatriz Marimon, from Universidade do Mato Grosso, who coordinated much of the Brazilian data collection in southern Amazonia, commented, "This is a good news story. We regularly hear how climate change and fragmentation is threatening Amazonian forests. But meanwhile, the trees in intact forests have grown bigger; even the largest trees have continued to thrive despite these threats."

The study found that both large and smaller trees have increased in size, consistent with benefiting from fertilization by increased atmospheric carbon dioxide.

Joint lead author of the RAINFOR paper Dr. Adriane Esquivel-Muelbert, from the University of Cambridge—who led the research while at the Universities of Birmingham and Leeds—commented, "Ahead of COP30 in Brazil later this year, these results underscore just how important tropical rainforests are in our ongoing efforts to mitigate against man-made climate change.

"Large trees are hugely beneficial for absorbing CO_2 from the atmosphere and this study confirms that. Despite concerns that climate change may negatively impact trees in the Amazon and undermine the carbon sink effect, the effect of CO_2 in stimulating growth is still there.

This shows the remarkable resilience of these forests, at least for now."

View of the rainforest canopy. Credit: Adriane Esquivel Muelbert

Dr. Rebecca Banbury Morgan from the University of Bristol and joint lead author added, "Our paper also highlights how destructive Amazon deforestation really is. Large tropical trees are hundreds of years old. We can't simply plant new trees and expect them to confer anything like the kinds of carbon or biodiversity benefits that the old, natural forest is providing."

According to previous research by the RAINFOR network, the Amazon Forest plays a key role in taking up carbon which would otherwise be in

the atmosphere.

"We knew that the total amount of carbon stored in the trees of intact Amazonian forests has increased. What this new study shows is that all sizes of tree have grown larger over the same period—the whole forest has changed," added Professor Tim Baker from the University of Leeds, joint senior author of the study.

The study is the first of its kind to measure how increases in CO_2 have systematically changed the tree size structure of Amazon forests. The team noted that as the biggest trees have grown larger, they have managed to increasingly dominate competition for resources.

The authors point out the new research has other implications too.

According to Professor Oliver Phillips of the University of Leeds, "What happens to big trees—including how they deal with increasing climate threats and manage to disperse their seeds—is now mission-critical. The only way the giants will stay healthy is if the Amazon ecosystem stays connected. Deforestation is a huge threat-multiplier and will kill them if we let it."

More information: Increasing tree size across Amazonia, *Nature Plants* (2025). DOI: 10.1038/s41477-025-02097-4.

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