

Scientists discover that rainforests take the heat

May 30 2013



Previous global warming events led to more diverse tropical forests. This is a view of the lowland tropical forest on Barro Colorado Island in Panama. Credit: STRI Archives

South American rainforests thrived during three extreme global warming events in the past, say paleontologists at the Smithsonian Tropical Research Institute in a new report published in the Annual Review of

Earth and Planetary Science. No tropical forests in South America currently experience average yearly temperatures of more than 84 degrees Fahrenheit (29 degrees Celsius). But by the end of this century, average global temperatures are likely to rise by another 1 F (0.6 C), leading some scientists to predict the demise of the world's most diverse terrestrial ecosystem.

Carlos Jaramillo, Cofrin Chair in Palynology, and Andrés Cárdenas, post-doctoral fellow, at the Smithsonian in Panama reviewed almost 6,000 published measurements of ancient temperatures to provide a deep-time perspective for the debate.

"To take the temperature of the past we rely on indirect evidence like oxygen isotope ratios in the fossil shells of [marine organisms](#) or from bacteria biomarkers," said Jaramillo.

When intense volcanic activity produced huge quantities of carbon dioxide 120 million years ago in the mid-Cretaceous period, yearly temperatures in the South American tropics rose 9 F (5 C). During the Paleocene-Eocene thermal maximum, 55 million years ago, [tropical temperatures](#) rose by 5 F (3 C) in less than 10,000 years. About 53 million years ago, temperatures soared again.

According to the fossil record, rainforests prospered under these hothouse conditions. Diversity increased. Because larger areas of forest generally sustain higher diversity than smaller areas do, higher diversity during warming events could be explained by the expansion of tropical forests into temperate areas. "But to our surprise, rainforests never extended much beyond the modern tropical belt, so something other than temperature must have determined where they were growing," said Jaramillo.

Jaramillo and Cárdenas' report also refers to findings by Smithsonian

[plant physiologist](#) Klaus Winter that leaves of some tropical trees tolerate short-term exposure to temperatures up to 122 F (5 C). When carbon dioxide concentrations double, trees use much less water, which is further evidence that tropical forests may prove resilient to climate change.

More information: Jaramillo, C., Cardenas, A. 2013. Global warming and neotropical rainforests: a historical perspective. *Annual Review of Earth and Planetary Sciences*. Vol. 4.

Provided by Smithsonian Tropical Research Institute

Citation: Scientists discover that rainforests take the heat (2013, May 30) retrieved 26 April 2024 from <https://phys.org/news/2013-05-scientists-rainforests.html>

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