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## Smithsonian Scientists Say Vines Strangle Carbon Storage in Tropical Forests

Although useful to Tarzan, vines endanger tropical forests' capacity to store carbon. In a major experimental study in Panama, Smithsonian researchers showed that woody vines, or lianas, slow tropical forest tree growth and may even cause premature tree death. Lianas reduced aboveground carbon uptake by more than three-quarters, threatening the forests' ability to buffer climate change.

Tropical forests account for a third of the total carbon fixed by photosynthesis. Lianas' increasing abundance may be driven by changing climate, increased disturbance or by more severe seasonal drought. By reducing the ability of tropical forests to accumulate and store carbon released through burning fossil fuels, lianas could cause a positive feedback loop, accelerating climate change.

"This study has far-reaching ramifications," said co-author Stefan Schnitzer, a biology professor at Marquette University and a long-term research associate at the Smithsonian Tropical Research Institute. "Lianas contribute only a small fraction of the biomass in tropical forests, but their effects on trees dramatically alter how carbon is accumulated and stored."

*Proceedings of the National Academy of Sciences* published the article co-authored by Geertje van der Heijden, a postdoctoral fellow at STRI and in Schnitzer's lab, and Jennifer Powers, a professor at the University of Minnesota.

Lianas are characteristic of lowland tropical forests, often making up more than 25 percent of species and woody stems. Because they depend on trees for support as they climb into sunlit treetops, they can invest a greater percentage of their own biomass in leaves.

Previous research by Schnitzer and colleagues showed that lianas can have significant negative effects on forest biomass growth and accumulation. These studies, however, focused primarily on tree growth, were restricted to forest gaps or were only observational. In this experimental study in Panama's Barro Colorado Nature Monument, all lianas were cut in eight experimental plots in 60-year-old secondary forest, but were left intact in eight others. For the next three years, researchers

monitored the growth in diameter of trees and lianas in the plot, and collected and weighed dead leaves and other debris falling from the forest canopy.

By the third year, lianas reduced net biomass accumulation by 76 percent per year in plots where they were present compared to where they had been removed. This decrease was due both to lower tree growth and to an increase in tree mortality where lianas were present. The proportion of biomass in leaves versus wood differed as well: forest canopy productivity—mostly leaves—decreased by 14 percent in liana-free plots, while the productivity of woody stems rose by almost 65 percent. Lianas not only lowered biomass accumulation, but also shifted it from wood, which stores carbon for a long time, to leaves, which rot quickly and release carbon back to the atmosphere.

These results have dramatic implications for the capacity of tropical forests to serve as a sink for carbon in the future. Simulating the change of biomass stocks over the next 50 years in forests with lianas and without them, the authors found lianas could reduce long-term storage of carbon by 35 percent. Even greater reductions could take place if liana-tree competition intensifies due to the spread of lianas, or causes an increase in the fast-growing tree species with low wood density.

While lianas clearly reduce the capacity for tropical forests to store carbon, Schnitzer emphasizes that lianas are an important and valuable component of tropical forests: “In terms of carbon, lianas may be detrimental; however, lianas provide a wide range of resources for wildlife, such as fruits, seeds and fresh leaves, and by connecting trees together lianas provide aerial pathways that are used by the vast majority of arboreal animals to move through the forest.”

The Smithsonian Tropical Research Institute, headquartered in Panama City, Panama, is a unit of the Smithsonian Institution. The Institute furthers the understanding of tropical nature and its importance to human welfare, trains students to conduct research in the tropics and promotes conservation by increasing public awareness of the beauty and importance of tropical ecosystems. Please visit our [website](#). Promo [video](#).

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van der Heijden, Geertje M.F., Powers, Jennifer S., and Schnitzer, Stefan A. 2015. Lianas reduce carbon accumulation and storage in tropical forests. *Proceedings of the National Academy of Sciences*.