Amazonian forests are vulnerable to repeated and coupled perturbations

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Solimões, the section of the upper Amazon River. Image: Wikipedia.

Intentional burning in tropical forests has accounted for nearly 20% of all greenhouse-gas emissions since preindustrial times and will have major implications for Earth's climate and biodiversity in years to come. To better understand the complex dynamics surrounding these fires, a team of researchers led by Jennifer K. Balch, of the University of Colorado-Boulder, conducted a six-year controlled burn experiment in an Amazonian rainforest block located in Mato Grasso, Brazil. The results are described in an article that is part of *BioScience*'s just-released Special Section on Tropical Forest Responses to Large-Scale Experiments, in the September 2015 issue.

The researchers tested three fire regimes—annual, triennial, and no burning. In the first three years of the study, trees in the experimental

plots proved resilient to the effects of fire, with low mortality in all of the areas. However, an extreme drought in 2007 led to more-severe fires and contributed to an abrupt increase in tree deaths. In the triennially burned plot, greater daytime drying allowed firelines to continue burning overnight, despite increased night-time air moisture and lower temperatures. The authors report that this could "explain how widespread forest fires can occur in Amazon forests."

In light of the coupled effects of fire and drought, the authors note that "seasonal closed-canopy Amazon forests can sustain initial fire disturbance but not repeated or coupled disturbances." They also found that the severe drought-fire effects led to a partial grassland transition, which fueled future burns. The authors highlight that this dynamic, if seen at larger scales, could have "substantial consequences for future flammability because grasses more than tripled fine fuel loads compared to forest litter."

Additionally, the authors argue that this grass incursion "will lead to a lower carbon state where observed aboveground forest carbon stocks may be reduced by 90%." Such changes "can potentially reverse the carbon sink observed in intact Amazon forests," with potential global-scale effects.

More information: The Susceptibility of Southeastern Amazon Forests to Fire: Insights from a Large-Scale Burn Experiment, DOI: 10.1093/biosci/biv106 . bioscience.oxfordjournals.org/

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