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## The past and the future of the tropical forest carbon sink: insights from permanent forest inventory plots

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Structurally intact tropical forests sequestered  $\sim 1 \text{ Pg C yr}^{-1}$  over the 1990s and early 2000s, equivalent to  $\sim 15\%$  of fossil fuel emissions. Climate-driven vegetation models typically predict that this carbon sink will continue for the remainder of the 21<sup>st</sup> century. However, recent plot inventories from Amazonia show a declining rate of carbon sequestration, potentially signaling an imminent end to the sink. Here we assess whether the African tropical forest sink is also declining.

Records from 244 multi-census plots across 11 countries reveal that the African tropical forest sink in aboveground live biomass has been stable for three decades, at  $0.66 \text{ Mg C ha}^{-1} \text{ yr}^{-1}$ , from 1985-2015 (95% CI, 0.53-0.79). Thus, the carbon sink responses of Earth's two largest expanses of tropical forest have diverged over recent decades. A statistical model including  $\text{CO}_2$ , temperature, drought, and forest dynamics can account for the trends. Despite the past stability of the African carbon sink, our data and model show that very recently the sink has begun decreasing, and that it will continue to decline in the future. This implies that the intact tropical forest carbon sink on both continents is set to end decades sooner than even the most extreme vegetation model estimates.

Published independent observations of inter-hemispheric atmospheric  $\text{CO}_2$  concentration indicate increasing carbon uptake into the Northern hemisphere landmass, offsetting a weakening of the tropical forest sink, which reinforces our conclusion that the intact tropical forest carbon sink has already saturated. Nevertheless, continued on-the-ground monitoring of the world's remaining intact tropical forests will be required to test our prediction that the intact tropical forest carbon sink will continue to decline. Our findings were recently published in *Nature* (March 2020) and have important policy implications: given tropical forests are likely to sequester less carbon in the future than Earth System Models predict, an earlier date to reach net zero anthropogenic greenhouse gas emissions will be required to meet any given commitment to limit the global heating of Earth.

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