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Including lianas in global vegetation models: first outputs from regional runs of ED2 in the Amazon basin

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Tropical forests are an essential component of the Earth system as they store and process huge quantities of carbon and water. They are estimated to store more than half of the global forest carbon stock (Pan et al. 2011) and therefore play a critical role for land surface feedbacks to climate change. They account for 34% of global terrestrial photosynthesis (Beer et al. 2010) and are acknowledged as global epicenters of biodiversity. Large-scale structural changes currently affect the tropical forest. Liana proliferation might be one of the most apparent impacts of the global changes affecting this biome and consequences could be important on the regional and global carbon cycle and therefore on climate change mitigation (Verbeeck and Kearsley 2015).

Because relatively little is known about liana functioning and ecology, it was implicitly or explicitly assumed that their role in forest dynamics was limited and could therefore be neglected in terrestrial ecosystems (Schnitzer and Bongers 2002). As a consequence, up to now, no single global vegetation model accounts for lianas while it was recently observed in a removal experiment that they substantially reduce tropical forest carbon storage, at least in high liana abundance conditions (van der Heijden, Powers, and Schnitzer 2015).

In this study, the Ecosystem Demography model version 2 (Medvigy et al. 2009), a vegetation model at the midpoint between gap models and area-based global models, was used for the first time to quantitatively assess the impact of lianas on the water and carbon cycles at the regional scale. Long-term simulations were run over the Amazon basin with different levels of liana abundance. To perform this analysis, historical gridded climate forcing datasets were used, covering several drought events. In this way, the impact of liana abundance on drought responses was quantified at the regional scale and new insights into the role of lianas on the carbon and water cycles generated.

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