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A stable isotopic view on lianas' and trees' below ground competition for water

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Various studies highlight an increase in liana abundance and biomass in the neotropics in the last decades. To date, the reason why this growth form expresses this trend is still unclear. One of the proposed hypotheses ascribes tropical lianas, in comparison to tropical trees, of being able to adapt better to increased drought conditions resulting from climate change. Moreover, lianas presumably have a deeper root system, providing access to deeper soil layers less susceptible for dehydration during drought events.

A dual stable water isotopic approach (δ18O and δ2H) enables studying vegetation below ground competition and in combination with Bayesian mixing models can provide insight in the fractional contribution of distinct soil layer depths. In this perspective, precipitation (bulk and through fall), bulk soil (at different depths), stream and xylem water of both lianas and trees were sampled between October 7-13, 2015. The study focusses on two distinct plots differing in soil texture (sand and clay), localized in close vicinity of the Guyana flux tower at Paracou (French Guyana).

Our study highlights the erroneous of the deep tap root hypothesis and provides new insights in water and nutrient competition between tropical lianas and trees during dry season. Lianas isotopic signature is enriched compared to those of trees. This can be linked to water source depth and soil seasonal replenishment. Moreover, liana displaying a very active soil surface root activity, efficiently capturing the low amount of dry season precipitation, while trees show to tap the deeper and less drought susceptible soil layers. A strategy, which not only results in a spatial niche separation in the underground competition for water, but it also provides lianas with a definite advantage in nutrient competition.