**Title**: Stem Respiration and Growth in a Central Amazon Rainforest

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**Project**: NGEE-Tropics (led by Berkeley Lab)
**Project Website**: https://ngee-tropics.lbl.gov/

**Project Abstract**:
Tropical forests cycle a large amount of $CO_2$ between the land and atmosphere, with a substantial portion of the return flux due to tree respiratory processes. However, *in situ* estimates of woody tissue respiratory fluxes and carbon use efficiencies ($CUE_W$) and their dependencies on physiological processes including stem wood production ($P_w$) and transpiration in tropical forests remain scarce. Here, we synthesize monthly $P_w$ and daytime stem $CO_2$ efflux ($E_S$) measurements over one year from 80 trees with variable biomass accumulation rates in the central Amazon. On average, carbon flux to woody tissues, expressed in the same stem area normalized units as $E_S$, averaged 0.90 ± 1.2 μmol $m^{-2}$ $s^{-1}$ for $P_w$, and 0.55 ± 0.33 μmol $m^{-2}$ $s^{-1}$ for daytime $E_S$. A positive linear correlation was found between stem growth rates and stem $CO_2$ efflux, with respiratory carbon loss equivalent to 15 ± 3% of stem carbon accrual. $CUE_W$ of stems was non-linearly correlated with growth and was as high as 77-87% for a fast-growing tree. Diurnal measurements of stem $CO_2$ efflux for three individuals showed a daytime reduction of $E_S$ by 15-50% during periods of high sap flow and transpiration. The results demonstrate that high daytime $E_S$ fluxes are associated with high $CUE_W$ during fast tree growth, reaching higher values than previously observed in the Amazon Basin (e.g. maximum $CUE_W$ up to 77-87%, versus 30-56%). The observations are consistent with the emerging view that diurnal dynamics of stem water status influences growth processes and associated respiratory metabolism.

**Reference**: Jardine K, Cobello L, Teixeira L, East M, Levine S, Gimenez B, Robles E, Spanner G, Koven C, Xu C, Warren J, Higuchi N, McDowell N, Pastorello G, Chambers J (2022). Stem respiration and growth in a central Amazon rainforest, *Trees,* 20:1-4.