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Intensive branch-level leaf demography complies with remote sensing approach, but not with the photosynthetic capacity seasonality: a preliminary result.

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Recently, it has been proposed that the dynamics of leaf production and loss, together with the variation of the photosynthetic capacity within leaf developmental stages, would be determining the annual carbon flux seasonality and dry-season increase of gross primary productivity – GPP – in Central Amazon. However, assessments of both leaf demography and photosynthetic capacity of different leaf ages in tropical forests have been mostly undertaken by medium to large-scale remote sensing approaches, such as phenocams and satellite indices coupled with eddy covariance technique, which could mask individual patterns of phenology habits and shifts in their photosynthetic performance. Considering this, our study focused on this leaf-level measurements of photosynthetic capacity (Vcmax 25ºC) along a leaf age gradient (8 to 612 days old) which were obtained by monthly monitoring of branch-level leaf demography and gas exchange field campaigns in an old-growth Terra-Firme Forest in Amazon Forest near Manaus, Brazil. To do so, we have selected 9 trees of different species and light environments accessed by scaffold aluminum towers and then we have monitored leaf dynamics (stock, flushing and shedding) from a sample of 10 to 30 branches per tree and also measured leaf-level gas exchange (A/Ci curves) and one-point photosynthesis (instantaneous). Preliminary results of intensive branch-level leaf demography show that there are substantial changes in leaf stock during the years (+21% in 2016; +44% in 2017; +32% in 2018) diverging with what has been evidenced by other studies using Leaf Area Index measurements in Central Amazon. However, there is a pattern in leaf shedding in the end of wet season and leaf flushing starting from end of wet season throughout the dry season, which was observed in two sequent dry season periods, conforming with previous results of broader scale approaches that named these events of intensive old leaves shedding and young leaves flushing with higher photosynthetic capacity in the dry season known as green-up. The photosynthetic capacity of individual species along a continuous leaf age gradient, analyzed by simple linear regression, exhibited high variability within leaves of the same age and species (up to 62%), and a different patterning among species, in which 6 out of 9 demonstrated a significant decline in Vcmax with age. When analyzed by community level (all leaves of all species pooled together), the relationship between Vcmax and leaf age in days showed a significant but modest decline from early mature to older leaves ($R2 = 0.17$; $p<0.001$). These results point out the importance of doing intensive small-scale assessments of GPP seasonality of the Amazon Forest, which those can be tested more in-depth. The findings of the study could possibly acknowledge the green-up theory, however when a more species-specific analysis in individual scale that accounts for vertical light profile, the explanation power of the theory may become unsteady. For these reasons, we postulate that a more integrative study between an intensive assessment of both leaf demography and photosynthetic capacity done and remote sensing is imperative in order to understand more about the GPP seasonality in the Amazon.