B11G-0108 Leaf demography and physiology of the Tapajós National Forest: could phenology cause a forest-level increase in gross primary productivity during the dry season?

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Tropical forests such as the forests of the Amazon basin are a significant component of the earth's carbon budget, yet how these forests respond to seasonal changes in weather, along with the extent to which tree biology synchronizes with seasonal cycles, are poorly understood.
For evergreen forests in equatorial Amazon that experience dry seasons, most global vegetation models project a dry-season decrease in gross primary productivity (GPP). However, eddy covariance observations and remote sensing assessments suggest a late-dry season increase in GPP.
Most global vegetation models assume that there is no seasonal variation in leaf phenology (cycles of leaf flush and senescence), or in leaf physiology. We conducted a case study in the Tapajos National Forest KM67 site, near Santarém, Brazil, to investigate whether leaf aging and seasonal shifts in leaf demography could cause an increase in GPP during the dry season. In a series of fieldwork campaigns beginning in August 2012, we monitored leaf demographic composition (leaf age categories) from 1-m branches collected from 20 trees representing abundant species, and we assessed how photosynthesis varies with leaf age for a subset of these trees.
Our results show that photosynthetic capacity (e.g. V_{cmax}) is higher for leaves that matured during the most recent dry season than for older leaves from previous periods of growth. For many trees, leaf demography shifted during the dry season such that recently matured leaves replaced old leaves. For instance, leaf demography of an *Erisma uncinatum*, the most abundant canopy tree species at our site, had significantly more recently matured leaves, and significantly fewer old leaves, during surveys late in the dry season (after mid-October) than early in the dry season (prior to mid-September). These results suggest that shifts in leaf demography together with the effects of leaf age on leaf physiology can increase GPP during the dry season at the KM67 site. Thus, leaf phenology may be a dominant driver of GPP seasonality in moist tropical forests of the equatorial Amazon.

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