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Amazon peatlands: quantifying ecosytem's stocks, GHG fluxes and their microbial connections

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Reports of hundreds of peatlands across basins in the West and Central Amazon suggest they play an important, previously not considered regional role in organic carbon (OC) and GHG dynamics. Amazon peatlands store ∼3-6 Gt of OC in their waterlogged soils with strong potential for conversion and release of GHG, in fact our recent, and others', efforts have confirmed variable levels of GHG emissions (CO_2, N_2O, CH_4), as well as variable microbial communities across rich to poor soil peatlands.

Here, we report early results of quantification of different components making up the aboveground C stocks, the rates and paths for GHG release, and microbial organisms occurring in three ecologically distinct peatland types in the Pastaza-Marañon region of the Peruvian Amazon. Evaluations were done in duplicated continuous monitoring plots established since 2015 at a "palm swamp" (PS), poor "pole forest" (pPF) and a rich "forested" (rF) peatlands. Although overall vegetation "structure" with a few dominant plus several low frequency species was common across the three sites, their botanical composition and tree density was highly contrasting. Aboveground C stocks content showed the following order among sites: rF>PS>pPF, and hence we tested whether this differences can have a direct effect on CH_4 emissions rates. CH_4 emissions rates from soils were observed in average at 11, 6, and 0.8 mg-C m^{-2} $h^{-1}$for rF, PS, and pPF respectively. However, these estimated fluxes needed to be revised when we develop quantifications of CH_4 emissions from tree stems. Tree stem fluxes were detected showing a broad variation with nearly nill emissions in some species all the way to maximum fluxes near to ∼90 mg-C m^{-2} h^{-1} in other species. *Mauritia flexuosa*, a highly dominant palm species in PS and ubiquitous to the region, showed the highest ranges of CH_4 flux. In the PS site, overall CH_4 flux estimate increased by ∼50% when including stem emission weighted by trees' species, density and heights. Flux estimates in p PF did not had a significant change. Analysis across species in the study sites, plus other satellite sites, suggest that in sites stem flux emissions might be conserved with some genera in the Aracaceae, Euphorbiaceae, and Sapotaceae families showing a large emitters capacity. Further characterization also showed that CH_4 flux emission from the stems decreases generally with height, suggesting a diffusion constrained stem flux, which seems limited by soil CH_4 concentration and wood density.

Finally, microbial community composition and methanogenic activity also showed contrasting patterns across sites, with pH being one of the major determinants. GHG producing organisms were detected in different proportions and types across study sites, and importantly methanogenic Archaea closely tracked observed differences of CH_4 flux among sites. Nevertheless, the link between vegetation type and density still remain under assessment in our efforts