Decoding the Secrets of Carbon Preservation and GHG Flux in Lower-latitude Peatlands

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The mechanisms regulating peat decomposition and C carbon storage in peatlands are poorly understood, particularly with regard to the importance of the biochemical compounds produced by different plant species and in turn peat quality controls on C storage and GHG flux. To examine the role of carbon quality in C accretion in northern compared to tropical peatlands we completed field and lab studies on bog peats collected in Minnesota, North Carolina, Florida and Peru to answer three fundamental questions; 1) is tropical peat more recalcitrant than northern peat 2) does the addition of aromatic and phenolic C compounds increase towards the tropics 3) do differences in the chemical structure of organic matter explain variances in carbon storage and GHG flux in tropical versus northern peatlands? Our main hypothesize is that high concentrations of phenolics and aromatic C compounds produced in shrub and tree plant communities in peatlands coupled with the fire production of biochar aromatics in peatlands may provide a dual biogeochemical latch mechanism controlling microbial decomposition of peat even under higher temperatures and seasonal drought. By comparing the peat bog soil cores collected from the MN peat bogs, NC Pocosins, FL Everglades and Peru palm swamps we find that the soils in the shrub-dominant Pocosin contain the highest phenolics, which microbial studies indicate have the strongest resistance to microbial decomposition. A chemical comparison of plant driven peat carbon quality along a north to south latitudinal gradient indicates that tropical peatlands have higher aromatic compounds, and enhanced phenolics, especially after light fires, which enhances C storage and affect GHG flux across the latitudinal gradient.