Geophysical Research Abstracts
Vol. 13, EGU2011-656, 2011
EGU General Assembly 2011

Leaf traits and biomass of tropical C4 grasses predicted with environmental drivers: A multi-continental analysis

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Information concerning soil properties, vegetation structure and leaf physiology was gathered from 30 tropical savanna sites distributed in 3 continents. Such information was then related to climatic measures in order to build predictive empirical models of above ground biomass and leaf level photosynthesis of C4 grasses. Multiple regression analyses identified growing season temperature, precipitation seasonality, soil water availability (W*) and soil nitrogen content (NSoil) as leading parameters in modeling C4 biomass. Similar approach was used to model leaf traits such as mass based foliar nitrogen content (NLeaf) and specific leaf area (SLA). Measured leaf level photosynthetic capacity did not differ significantly among studied regions, as large variability within regions was observed. Mass based maximum carboxylation capacity (Vcmax) was positively related to other leaf traits as SLA (r2=0.47), foliar sulfur content (SLeaf) (r2=0.28), NLeaf (r2=0.24), and foliar phosphorus content (PLeaf) (r2=0.05). Higher SLeaf was significantly related to higher nutrient use efficiency, although exact mechanisms are not clear. Finally, Vcmax was better predicted by a multiple regression model involving SLA, length of the dry season and W*. Such results indicate that current global photosynthesis models that compute tropical C4 photosynthesis could be significantly improved as they currently rely on Vcmax derived solely from NLeaf.