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Modeling light competition in the Amazon forest: the effects of high CO_2 in functional diversity and biogeochemical cycle.

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The increase of CO_2 concentrations implies direct and indirect (by changing climate) impacts on the terrestrial ecosystem. Several Dynamic Global Vegetation Models (DGVMs) have been developed to better understand the response of vegetation to climate change. However, the representation of plant diversity through a small set of Plant Functional Types (PFTs) adopted by the majority of DGVMs undermines their ability to represent functional diversity and fundamental interactions between these different life strategies of plants, like competition, which has been shown to be paramount in determining ecosystem functioning. Studies have shown that increasing CO_2 concentration may determine the outcome of vegetation competition and, as a consequence, the ability to adapt to the environment, functional diversity, and community assembly mechanisms. Thus, the inclusion of competitive dynamics in these models becomes strategic to improve predictions and understanding the effects of climate change on vegetation and how it affects change in carbon fluxes and stocks in the community. In that sense, this project aims to contribute to the development of a light competition module within CAETÊ model (**C**Arbon and **E**cosystem functional **T**rait **E**valuation model) which involves the implementation of allometric relations between plant organs. As a trait-based model, CAETÊ seeks to represent plant functional diversity in a less discrete way through the usage of variant values for functional traits. For this purpose, two key functional traits that are closely related to competition for light are employed as variants: *wood density* (WD) and *specific leaf area* (SLA). The main objective is to understand how light competition related to plant functional traits alters the response of Amazon plant communities under changing environmental conditions. As preliminary results, the algorithms containing the allometric and competition equations were developed outside the main model code and represent plant dynamics trade-offs between the variant functional traits and plant physiology and survivorship: WD relates to strategies of mortality and height growth. For example, high values of WD [1g/cm^{-3}] are related to low heights [~30m.] and, low heights incur higher mortality rates; SLA relates to light competitive effect, Leaf Economics Spectrum, and LAI (leaf area index) determination, one of the most important parameters that determine the absorption of

light by different life strategies. These trade-offs allow the representation of different plant life competition strategies. We expected that the light restriction for some functional strategies may incur a decrease in functional dominance and photosynthesis rate, consequently changing net primary productivity and after all the functional structure of the community. For functional diversity, it is expected changes in functional richness and functional divergence (related to the strength that competition exerts in the community) in order to favor strategies that better deal with the new environmental conditions simulated by CAETÊ with increasing [CO_2] to 600 ppmv, for example. Finally, it is expected that this approach may contribute to improving the representation of competition for light in DGVMs to more assertively obtain the effects of climate changes on vegetation and ecosystem dynamics. Final results will be obtained until the EGU Congress takes place.