

Increase in functional diversity in drier climate conditions can buffer reduction in Amazon forest carbon stock

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The uncertainties on the effects of climate change on functional diversity and its consequences for ecosystem processes (e.g. carbon stock) are especially important in hyperdiverse ecosystems such as Amazon forest. This study aimed to understand how a decrease of 50% in precipitation affects the functional diversity of Amazon forest and how it influences its capacity to store carbon. For this, we have used two versions of the same trait-based model (CAETÉ – Carbon and Ecosystem Functional Trait Evaluation model). The low diversity version (LD) characterized the vegetation through 5 plant functional types with values for functional traits fix in space and time. The high diversity version (HD) allows the values for functional traits to be variant and simulates thousands of different ecological life strategies that differ in terms of the values for functional traits. Six functional traits were used: allocation and residence time of carbon in three plant compartments (leaves, aboveground woody tissues and fine roots). The HD version avoided a loss of 1.6 Pg of carbon when compared to the LD version. This was possible because HD allows a change in community composition: we observed a decrease in dominance what enable new combinations of traits to compose the community, leading to an increase in functional diversity both when analyzing traits separately and in a multi-trait analysis. These new strategies presented more carbon allocation and increased residence time in fine roots resulting in a biomass increase in this compartment which allowed a higher absorption of water. This study shows the importance of incorporating the diversity of trait values in vegetation models when researching for the effects of climate change in terrestrial ecosystems. It also suggests that drier conditions can change functional diversity in Amazon forest that can act as a buffer to the effects of climate change.

Este trabalho foi apresentado oralmente no evento científico ATBC 2019 ocorrido de 30/04/19 a 03/08/19 em Antananarivo, Madagascar.

