The quest to represent a more reliable representation of functional diversity in vegetation models and, supposedly, as a consequence, a higher confidence in its projections lead to the development of trait-based models. However, few studies so far have investigated in depth if the inclusion of trait variability in fact improves the representation of ecosystem properties such as NPP and biomass, an important refinement that could can improve reliability for projections with future climatology. Additionally, trait-based models also open an unique opportunity to provide insights into active ecology areas of debate, such as the role of functional diversity in ecosystem response to projected disturbances like climate change, and how functional diversity itself respond to these disturbances. However, this exploitation potential of trait-based models has yet to be fully accessed and can be considered as far reaching especially for community ecology.

Here, in this modeling exercise, we compared for the first time how the use of a PFT approach (widely used by vegetation models) differs from a trait-based approach in terms of current representation of carbon storage and NPP; the impacts of these two approach employment for carbon storage and for functional diversity in a reduced precipitation scenario and how changes on functional diversity components is connected to carbon storage responses.

In this study, the use of a PFT based approach and a trait-based approach applied with the same model, served as a proof of concept to strengthens the significance of incorporating functional diversity in vegetation models. For example, our results evidence that the inclusion of trait variability can improve accuracy in representing biogeochemical variables and also show that trait-based models, such as CAETÊ, are important tools to investigate community ecology mechanisms and processes that link biodiversity (mainly functional diversity) and ecosystem functioning. For example, we found, consistent with expectations, that more diverse communities (trait-based approach) can deal better with environmental changes since it provides a higher range of responses, what enables a community functional reorganization that can buffer, by maintaining or diminishing, the impacts of disturbances in ecosystem properties. On the other hand, because of its limited capacity to change community functional structure, the use of PFTs may overestimate the impacts of environmental changes.

Besides, our trait-based framework showed to be a first step into the study of the different components of functional diversity (richness, evenness and divergence) against climate change and its connection with ecosystem functioning. For instance, we found, unexpectedly, that a harsher environment can increase functional richness instead of decreasing it, what can be attributed to a reduction in hyperdominance and then creating space to new functional traits combination to occupy functional space. This type of result can be used to understand mechanisms such as community assembly rules.

In conclusion, this study demonstrated that the CAETÊ framework for including trait diversity in vegetation model is feasible and can be used in future studies, being flexible enough to be applied in several climatic scenarios and using different functional traits, hence, constructing a robust foundation to advance in the understanding of the impacts of climate change in Amazon forest and other natural ecosystems.

It has already been improved to be an DGVM an to include nutrient cycling, competition, phenology, water balance

However other traits may be mo tightly connected to the drought effects such as those linked to water.

However the inclusion of other traits may be very important, especially if it is used to understand the drought effects.

Our results also highlights the estreita relação entre diversidade funcional e seus diferentes componentes para determinação do funcionamento ecosistemico.

PFT may not allow since its very restrict variety of responses, leading to an overestimation of the impacts

-resultados não esperados como por exemplo o aumento da diversidade funcional com a aplicaç;ao de um distúrbio e a importancia de atributos/estrat´egias raras

- pela primeira vez efeito na DF e como isso se comunica com as respostas das variáveis biogeoquímicas. Inesperadamente a riqueza aumentou