The impacts of projected reduced precipitation on functional diversity and how its components (richness, evenness, divergence and composition) modulate the Amazon forest carbon sink remain underexplored and elusive. Herein, we present a novel trait-based approach, the CArbon and Ecosystem functional-Trait Evaluation (CAETÊ) model to investigate the role of trait diversity for projecting net primary productivity (NPP) and carbon storage in current climatic conditions and also for carbon storage under low precipitation. We employed CAETÊ using two approaches to represent two levels of functional diversity: (i) low: using three plant functional types (PFTs) with fixed trait values (PFTA) and (ii) high: applying a varying trait-based approach (TBA) with a semirandom combination of trait values, creating 3000 plant life strategies (PLSs). Six functional traits were considered: carbon allocation and residence time in leaves, aboveground woody tissues and fine roots. The inclusion of trait variability improved model performance in representing NPP and carbon storage from observations. When applying a 50% precipitation reduction scenario, increased investment in fine roots indicated a change in functional composition in the TBA which made the community less sensitive to limited water availability. Hence, we found that the TBA, compared to PFTA, presented a higher ability to functionally reorganize in response to lower precipitation, through changes in the abundance of the PLSs in the community, which better occupied the functional space by changing its functional diversity components (increase in richness and evenness and decrease in divergence). Consequently, new functional niches were created in the TBA, enabling new, or previously rare, trait combinations to emerge from the species pool,. The use of too few PFTs in the PFTA overestimated the impacts of environmental changes due to limited capacity to reorganize, and hence, results from the PFTA should be interpreted with caution. These results suggest that functional diversity plays a vital role when evaluating the sensitivity of ecosystems to climate change. We therefore conclude that by accounting for trait variability in vegetation models we will be able to derive more realistic projections of ecosystem processes under future scenarios, thus paving the way for a better understanding the biodiversity-ecosystem functioning relationship**.**

**Keywords:** trait-based modeling, climate change, carbon allocation, trait space, functional reorganization, Amazon forest