Community level plant functional strategies explain ecosystem carbon storage across a tropical climatic gradient of Kilimanjaro

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Abstract

- Plant functional traits play a pivotal role in shaping plant ecological responses to environmental conditions and influencing ecosystem functioning, however, our knowledge about whole plant trait's coordination's to inform community level functional strategies across climatic gradients and their influences on carbon storage remain poorly understood.
- Using the advantages of the broad climatic gradient of unique tropical mountains of Kilimanjaro, we test the existence of the functional trait's covariation between aboveground and belowground traits to represent the community level plant strategies which drive the carbon storage, and associates the strategies to carbon storage.
- To do so we calculate the community level functional measures and examine their functional strategies using multivariate analyses. Further we perform structural equation models to evaluate the existing mediated effects of functional strategies mainly functional composition on the aboveground and soil carbon storage.
- Our results revealed two functional plant strategies, the slow-fast and woody-grass community represented from the two principle component axes. The slow-fast strategy span from the community with conservative trait syndrome composed of specific wood density and leaf dry matter content to acquisitive traits syndrome composed of fine root nitrogen concentration and specific leaf area, while woody-grass community span from community with large trees forest type composed of high canopy height and root tissue density to grass type community with more nutrient foraging syndrome composed of high specific root length. Both strategies were strongly associated with aboveground carbon and only *woody-grass* community axis influenced soil carbon storage. Thus, higher carbon storage was linked to woodiness and fast-growing plant communities within ecosystem. Considering both direct and indirect plant strategy mediated, effects, annual precipitation exerts a positive effect on carbon storage, while mean annual temperature has a negative impact.
- *Synthesis.* We demonstrate that major plant strategy axes could be manifest at the community level along climatic gradients and explain between ecosystem variation in carbon storage. We emphasize the ecosystem communities with fast growing forest trees with mutualistic properties for greater carbon sequestration potential.

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