Leaf traits of understory species are changing in response to climate change in the Congo Basin Forests

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Abstract

Background– While tropical forests play an important role, in carbon sequestration, tropical species are assumed to be sensitive to rising temperatures and prolonged drought predicted to occur in the region. Plant functional traits are useful tools for understanding and predicting possible changes in plant communities.

Objective– We analysed the variation of foliar traits of woody understory species of the Yangambi Man and Biosphere Reserve and verify if this variation is potentially related to recent climate change.

Methods – Leaves of five shrub species were collected, in the 2019-2022 period in Congolese old-growth forest (Yangambi MAB Reserve, DR Congo), from different positions on the shrub to evaluate the variation within individua and as such test the possibility to use (historic) herbaria for the study of foliar traits. These leaves were compared to herbarium specimens collected in the same area in the 1935-1960 period. In both studies we assessed leaf size, specific leaf area, stomatal size and stomatal density for all species.

Results –This study shows that the variability of the functional traits of the woody understory species are independent of the position of leaves in the crown. This makes it possible to use historic herbarium for trait analyses from tropical undergrowth shrubs. Characteristics of the recently collected leaves were notably different as compared to the herbarium leaves collected between 1935-1960. Recent leaves were significantly larger, had a higher SLA, and a smaller stomata pore length as compared to historical herbarium specimens.

Conclusion – The difference in measured trait characteristics over time correlates with the upward trend of the average temperature measured in the area over the last 80 years in Yangambi, while average annual rainfall had remained unchanged.

Our results provide a first insight into the response of forest species to climate change in the forests of the Congo Basin, and how the undergrowth species and the ecosystem will react in the longer term when temperature further increases. However, as our study is based on a limited number of species and only for one region a more extensive study is needed.

Keywords: Climate change, leaf traits, understory woody species, Congo Basin Forests, Yangambi