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Closing the data gap to develop Land Surface Models for Congo Basin forests

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Congo Basin forests are among the most diverse, carbon-rich and CO2-absorbing areas in the World (1,2) and play an increasingly important role in international climate policy (3). On the pivotal CoP26 in Glasgow, more than 100 World leaders promised to stop deforestation by 2030, including specific pledges to focus on protecting Congo Basin forests. However, there is a striking discrepancy between the Congo Basin's paramount importance versus its poor scientific coverage (4). As a result of this data gap, Earth System Models are not capturing present-day tropical forest carbon dynamics (5). Therefore, our consortium is contributing to closing the Congo Basin forest data gap and improve Land Surface Models to capture its biodiversity and carbon dynamics. To reach this ambition, we are collecting field data on permanent forest inventory plots scattered across the Congo basin.

The data covers multiple time scales by combining different methodological approaches: (i) weakly monitoring of cambial and foliar phenology of selected trees in the plots provides seasonal- and annual-scale changes in carbon uptake, (ii) repeated tree diameter and height measurements of all trees in the plots reveal decadal-scale changes in the carbon balance and tree community composition, (iii) measuring whole-tree, wood and leaf traits on selected trees in the plots allow in-depth analysis of decadal-scale changes in taxonomic and functional composition, (iv) identification of radiocarbon dated soil charcoal sampled in the plots reveal century-scale and millennial-scale changes in biodiversity, (v) continuous monitoring of climate variables provides yearly and decadal-scale changes in temperature and water availability.

By themselves, those data shed light on the short- and long-term resilience of critical Congo Basin forest ecosystem functions. Here we present an overview of recently published and preliminary results showing how our consortium contributes to advance our understanding of the effects of environmental change on vegetation dynamics, tree mortality and carbon dynamics of Congo Basin forests. Combining all these collected field data will ultimately allow to parameterize and validate Land Surface Models specifically for the Congo Basin.

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