DAMOCO

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

DURATION
1/09/2022 – 1/12/2026

BUDGET
983 320 €

PROJECT DESCRIPTION

The Congo Basin plays a crucial role in the fight against climate change. On the one hand, Congo Basin forests are more efficient at slowing climate change, more carbon-dense, and more resistant to our changing climate than any other tropical forest. On the other hand, human pressure on Congo Basin forests might contribute to accelerating climate change. Deforestation in the Democratic Republic of the Congo (DRC) surpasses 1 Mha per year and is expected to intensify due to four-fold growth in local human population by the end of this century coupled to the shifting cultivation system (slash and burn agriculture). Less visible but equally important threats are rapidly changing climatic conditions, leading to loss of biodiversity, severe dieback of trees, saturation of their carbon sequestration potential, surpassing critical thresholds, and changes in physiological water-use efficiency. Land-use and climate change together might push the Congo Basin beyond a tipping point, after which the ecosystem cannot recover to its original form. Understanding the sensitivity and the resilience of Congo Basin forests is crucial to predict the fate and the role of this important ecosystem under different climate and land-use change scenarios.

There is a discrepancy between the Congo Basin's paramount importance on the one hand and its poor scientific coverage on the other. As a result of this data gap, Congo Basin carbon stocks and fluxes are ill-understood, with mismatches greater than 100% among regional maps, and large uncertainties in land fluxes. Furthermore, the two latest generations of Earth System Models are not capturing present-day African forest carbon dynamics, and hence generate contrasting projections of the effects of climate and land-use change.

The ambition of this project is to contribute to closing the Congo Basin forest data gap and apply the data to develop a next-generation Land Surface Model, specifically designed to project the fate of central African forests under contrasting climate change scenarios.

To reach this ambition, we will :

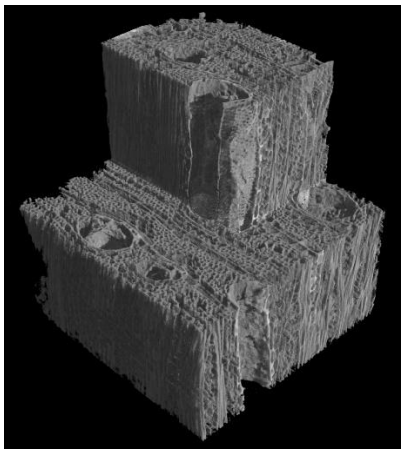
(1) collect new data on permanent forest inventory plots scattered across the Congo basin. The data will span multiple time scales by combining four different methodological approaches: (i) eddy-covariance data from CongoFlux (an ICOS ESFRI station) will provide (sub-)daily measurements of carbon and water fluxes; (ii) repeated tree measurements will reveal decadal-scale changes in the carbon balance, (iii) measuring a wide array of tree traits on the plots will allow in-depth analysis of decadal-scale changes in taxonomic and functional composition, and (iv) identification of radiocarbon dated fossil charcoal will reveal century-scale and millennial-scale changes in biodiversity. By themselves, those data will shed light on the short- and long-term resilience of critical Congo Basin forest ecosystem functions.

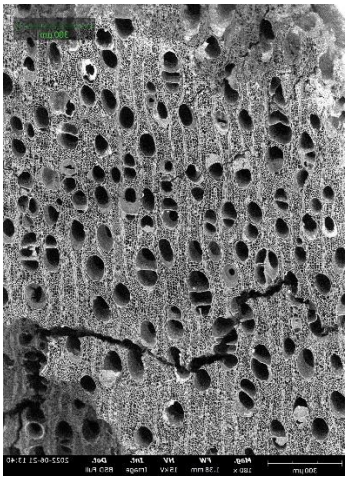
(2) combine all collected data to parameterize and validate the Ecosystem Demography model (ED2) for the Congo Basin forest. Finally, we will use the newly parameterized and validated model to simulate future dynamics of Congo Basin biodiversity and carbon balance under different emission scenarios.

DAMACO

The project will have a major scientific impact because the data will be made available through well-known and widely used scientific repositories, which all struggle with a common data gap in the Congo Basin. The project will contribute to capacity building by coaching Congolese students to become future science leaders. Finally, at the end of this project the Democratic Republic of Congo will have refined information on its past, present and future forest ecosystem and climate services, which will foster major policy impact at the national and international level.

DAMOCO is an innovative project: It will spark a step-change in our understanding of tropical forest functioning by targeting an unprecedented combination of unique datasets with a state-of-the-art land surface model to generate the first region-specific parameterization of central Congo Basin forests. Through different but complementary scientific approaches, a multi-temporal record of forest dynamics will be created for one of the most enigmatic areas on Earth: the central Congo Basin. The data will cover several major forest types in the Central Congo Basin and all successional gradients (pioneer, regenerating and mature forest). DAMOCO is a high-gain project forcing important breakthroughs in multiple scientific fields and providing relevant information for policy makers.





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