

Aligning carbon dynamics and landscape evolution in tropical Africa throughout the Late Holocene

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The second largest rainforest biome on Earth lies in the Congo Basin in central Africa. Its ability to absorb atmospheric carbon is among the highest globally, amounting to approximately 3.5 kg C m⁻² year⁻¹ [1]; the Congo Basin thus plays a crucial role in the global carbon cycle. However, due to slash-and-burn agriculture, the rainforest is quickly contracting, diminishing its ability to absorb these same amounts of atmospheric carbon. Interestingly, former studies have observed a change from rainforest to savanna-dominated vegetation in Central Western Africa approximately 3000 years BP [2,3,4]. If triggered by anthropogenic factors, this so-called “Rainforest Crisis” may serve as an analog for ecosystem responses to ongoing deforestation today. However, since historical data from tropical Africa are scarce, more information is needed to understand the influence of landscape evolution on carbon dynamics in an area that is facing severe deforestation.

To provide such information, we collected lake sediment cores located along the rainforest-savanna boundary in the Kasai Basin, Democratic Republic of Congo, which constitutes the southwest portion of the Congo Basin. We derived sedimentation rates from radiocarbon-based age models and measured total organic carbon and specific surface area in approximately 10 cm intervals to calculate mineral surface area-specific OC loadings. Combining sedimentation rates with loadings provides insights in the organic carbon transport and burial rate. Vegetation changes throughout the last 4000 years BP were identified by pollen counting. We found high organic carbon loadings coupled with high sedimentation rates in the last 2000 years BP, aligning to a shift from a rainforest- to a savanna-dominated landscape. These findings indicate higher erosional transfer of soil in the past 2000 years BP.

Further analyses of climate proxies are planned to better predict how the Congo rainforest will respond to today’s climate- and land use-triggered challenges.

References

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