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What does the study of swamp ecological transition(s) tell us about past climatic conditions in East Africa?

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Peatlands represent only 3-5% of the total world land cover (Gorham, 1991) but approximately 20-30% of the total carbon storage of the world. However, they have so far been scarcely used as paleoclimate archives. The aim of this work was to reconstruct past climate and ecological changes through a high-resolution multi-proxy study of a 4 m peat core collected in the Kyambangunguru swamp (SW Tanzania). This core covers the last 4,000 years based on 14C dating of bulk organic matter and macro-remains. Microscopic observations – macro-remains, micro-fossils, palynofacies and pollen – and geochemical analyses – organic carbon and nitrogen contents, branched glycerol dialkyl glycerol tetraethers (br GDGTs), n-alkanes and their H isotopic composition – were combined to track potential ecological changes in the swamp and to relate them to climate forcings. This approach revealed an abrupt ecological transition ca. 2,300 yrs BP ago, when the ecosystem likely changed from a lake to a marsh. In addition, climate variations were investigated through the analysis of specific organic compounds, i.e. long chain n-alkanes and br GDGTs. On the one hand, the change in ecosystem functioning seems associated with an increase in mean annual air temperature of ca. 1 °C according to br GDGT-derived temperature estimates. On the other hand, the hydrogen isotopic composition of plant derived n-alkanes (δ^2Hwax), which is related to the isotopic signature of precipitations and with hydrological regimes, did not show any abrupt shift at this period. In conclusion, high coherence between vegetation changes and climate modifications recorded by different proxies was observed along the core. They all indicate the transition from a lake to an acidic marsh ca. 2300 years ago. The onset of marsh formation may have been driven by hydroseral succession processes, i.e. the lake overgrowth by macrophytes, and may have been favoured by a warming climate and a long-term progressive trend towards increased rainfall seasonality at this period, as previously observed in other wetlands of the region (Gasse, 2000).

References:
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