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Large-scale impacts of climate change on tropical West African ecosystems over the past ~540,000 years

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A paucity of empirical non-marine data means that uncertainty surrounds the impact of climate change on terrestrial ecosystems in tropical regions. The sedimentary-fill of the Bosumtwi impact crater (Ghana) provides the longest Quaternary terrestrial archive of environmental change in Africa, spanning the last ~540,000 years. Here we present a reconstruction of vegetation biomes and moisture availability in tropical West Africa for the past ~540,000 years using pollen analysis and the nitrogen isotope composition of bulk organic matter preserved in sediments from Lake Bosumtwi. Variations in grass pollen abundance (0–99%) indicate abrupt transitions between savannah and woodland biomes.

Coeval variations in the nitrogen isotopic composition of organic matter indicate that intervals of savannah expansion coincided with minimum lake-levels and low regional moisture availability. The observed changes responded to orbitally paced global climate variations on both glacial-interglacial and shorter timescales. Importantly, the magnitude and abruptness of ecosystem change revealed by our data exceeds that previously determined from marine records, demonstrating for the first time the true sensitivity of tropical regions to Quaternary climate change.