A palaeovegetation and diatom record of tropical montane forest fire, vegetation and hydroseral changes on Mount Kenya from 27,000-16,500 cal yr BP

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Fire is an important ecological disturbance in moist tropical forests influencing vegetation composition and structure. Contemporary and historical records of forest fires in mountain forests of Kenya are limited to the past decades and have a strong anthropogenic influence for ignition patterns and fire suppression activities. Palaeoenvironmental geoarchives provide the temporal depth to investigate long-term (multidecadal-to-millennial) changes in fire activity. Here we use a sediment record from the Rumuiku wetland, located in a volcanic crater on the eastern flank of Mount Kenya that was radiocarbon dated and analysed for diatom, pollen and charcoal subfossils to produce a highly resolved time series of local hydroclimatic change, vegetation, and fire; respectively. This study focuses on the time during and following the global Last Glacial Maximum, a time of rapid warming and changing regional hydroclimate with relatively stable atmospheric CO2 and not yet intensive anthropogenic modification of ecosystems. Charcoal and pollen data support associated changes in vegetationfire centred around 21,500 cal yr BP when Afromontane forests with predominant abundances of Juniperus, Podocarpus and other montane forest trees changed to Hagenia-dominated forests that are relatively more open and adapted to burn more frequently but with less intense fires. These transitions in ecosystem composition, distribution and structure support the important role of fire in driving and maintaining forest composition in the watershed and contributing to the spatial complexity of forests around the mountain. These changes in composition, structure and biomass occurred during a time of rapid Late Pleistocene climate warming, regional hydroclimatic drying, and slowly rising atmospheric CO2 from 27,000 to 16,500 cal yr BP, during and following the conditions of the global Last Glacial Maximum. Temperature, hydroclimate and atmospheric CO2 are well-known drivers of montane vegetation change in the tropics and the role of fire is shown here to be a contributing driver to the spatial heterogeneity of forest patches at long time scales. Vegetation modelling at spatial scales relevant to land management and conservation should include retrospective evidence of the range of drivers of ecological disturbance regimes.

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