Afromontane-Afroalpine ecosystems as long-term sensors of environmental change.

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The two most important African mountain ecosystems are the Afroalpine and Afromontane ecosystems. Ranging in altitude from 2000 to more than 4500 m asl, they hold distinctive endemic faunas and floras. The best preserved examples are in the Ethiopian highlands but these still face the challenges of current global change, including increasing human action. Their high-altitude ecological communities are very sensitive to environmental fluctuations, being limited to relatively small areas. They are thus often the focus of ecological research, since conservation managers need informed evidence as the basis for management decisions. However little is known of their response to long-term environmental change, which is critical for understanding their likely response to future global change.

Palaeoenvironmental records from the Ethiopian highlands show patterns of increasing temperature and changing regional rainfall since the last glacial that may be linked to vegetation dynamics and human agency. We hypothesize that African mountain ecosystems are sensitive to climate variation and anthropogenic disturbance while being resilient to long-term change. We thus aim to answer the following questions: 1) How have varying moisture patterns affected the Ericaceous belt from the Lateglacial to the present? 2) What are the relationships between climate, vegetation and fire in these ecosystems?

To address these questions, we revisit lake Garba Guracha (GGU, 3950 m asl), presenting a new palaeoecological record of the last 16 kyrs. Our new record includes high-resolution time series of pollen, charcoal, diatoms and stable isotopes (δ^2H and $\delta^{18}O$), where the latter constitute independent evidence of climate variation. The Lateglacial landscape at GGU was an open, dry, steppe-like environment. The record shows increasing moisture and temperature from16 ka BP to the mid-Holocene (11-6 ka BP), concurring with the African Humid Period. Vegetation cover responded rapidly to the increasing moisture, with denser Ericaceous vegetation and thicker forest in the lowlands from the Holocene onset. This clear response of the Ericaceous belt to climate change is partially modulated by fire activity, which is dependent on biomass as a limiting factor, establishing a climate-vegetation-fire loop. The coupled climate, heathland, and fire dynamic is punctuated by drought events until 5 ka BP, when a longer, drier period established, lasting to the present and defining a new landscape where human impact became clearly distinctive. We discuss our results in the light of conservation measures for Afromontane and Afroalpine environments.