

Interactive comment on “Palaeoenvironmental perspectives for sustainable development in East Africa” by R. Marchant et al.

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Thank you very much to the reviewers for thought-provoking comments.

There is a suggestion that this paper uses similar arguments put forward in the Willis and Bhagwat paper on 'Questions of importance to the conservation of global biological diversity' submitted to the same issue of *Climates of the Past*. I have subsequently looked at this paper (it was submitted after our manuscript) and indeed there are some common threads between these two papers. I feel this is excellent as these are independently coming up with similar calls to the community to use palaeoecological data in an applied way and emphasises the value of the long-term perspective inherent in palaeoecological records to communities outside of palaeoecology. Importantly, there are significant differences in the two papers and I feel the overlap is minimal.

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Willis and Bhagwat focus on the under-used nature and value of the palaeoecological record for understanding drivers and changes behind biodiversity and broader ecosystem dynamics. Similarly, our paper bemoans the lack of the use of the palaeoecological records but stresses the under-used potential for issues of understanding broader scale ecosystem-environmental-human interaction. Specifically, how the comprehension gleaned from the palaeoecological record in East Africa can be used for managing ecosystem change and hence feed into the sustainable development agenda.

It is suggested that the paper does not present new concepts. Indeed, there are not the developments of new concepts in the paper – and something that is paralleled with many review style papers. What is new is that the paper reinforces and develops suggestions that have been aired over the past 15 years of working in East African palaeoecological study – that there is much greater potential uses of palaeoecological data than just describing past ecosystem changes and discussing the nature and magnitude of the climate or anthropogenic focus that could have driven such a change. However, a central novel aspect is that it is only now that the data coverage and quality has reached a critical mass that palaeoecology in East Africa can now make the move from being largely descriptive, to being useful within a more applied context. Thus, although not 'new' we believe there is (or soon will be) a shift in the use of palaeoecological records. This is exemplified by the case studies throughout the paper given that are from locations where there are very strong linkages for populations to ecosystem services and show very clearly the potential of palaeoecological studies, particular given the current debates surrounding climate change and ecosystem response, and how best to manage this in East Africa.

It was suggested that the article was bemoaning the relative neglect of anthropogenic impacts on East Africa ecosystems – there may have been some ambiguity in our message, or that way that this was phrased was misleading. To reiterate, we bemoan the number of studies that have been conducted tending to focus on a 'human impact' narrative rather than one of 'human interaction' and how this has changed as popula-

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tions and ecosystem interactions have evolved alongside technological advances and import of new crops and land management techniques.

It is suggested that the 'only' palaeo data presented are in the synthesis figure 4, and that this would be best placed in the introduction. This figure presents palaeoecological data from three very new sites (2 Kenyan (2009, 2010) and 1 Tanzanian (2011)). These three different sites cover a range of time scales and are from different ecosystems but in combination and summary form present some very interesting inter-site synergies. These are excellent data and have been presented in a new way that allows easy access from the non-palaeoecological specialist – again vital if the central tenant of the manuscript 'for palaeoecological data to have a broader use' these data have to be presented in a way to be accessible to the broader community.

As suggested by one of the reviewers a new regional synthesis figure could be developed to set the context for the paper. A figure has been produced that provides an overview on Ecosystem, Atmospheric, Temperature, Hydrology and Anthropogenic signals from East Africa presented on a log scale. By presenting the data against a temporal log scale we are able to emphasize the events that have been 'more' important in determining the present day coupled human-environmental-ecosystems inter-relationships. As suggested by the reviewer, it has indeed been a challenge to create but I believe that will be beneficial to the wider community and clearly demonstrates the magnitude and trajectory of the changes East Africa has undergone. In addition to providing excellent context this can act as a 'straw doll' that other records can be compared against. The new figure also emphasises that although the more recent past (the Holocene) is indeed particularly pertinent for understanding human-environmental-ecosystems interactions, and hence can have applicability to the sustainable development agenda, the long term perspective is also central to this. Although the recent events have the most resonance with the present day coupled human-environmental-ecosystem, having a longer term perspective is vital – this is also quite clearly demonstrated in the new synthesis figure. Such a long-term perspective not only places

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the current changes in context, as we undergo the transition from a warm interglacial characterised by high levels of atmospheric CO₂ to a warmer higher CO₂ future, it is particularly trite in understanding the response of ecosystems to altered CO₂, provides context on climate and ecosystem evolution, and test data for models developed to forecast future climates.

The suggestion that the present day issues of forest clearance and reduced interaction with hydrology is not analogous to the situation at the LGM is open to debate. We agree that this really needs testing in a structured way but there are very interesting parallels between the reduced forest cover characteristic of many East African mountains today and that the LGM. Although this hydrological change has clearly resulted from very different forcing mechanism both have resulted in reduced 'collection' of water from the East African highland water towers. Understanding the functioning and mechanism of vegetation-moisture interactions is crucial to understanding hydrological budgets and broader impacts of deforestation and hydrological resources – again this will be exemplified with some new and current case studies from East Africa.

There is suggestion that the Bantu migration is separate from the abrupt drying of 'North' Africa – we do not agree with this and feel it is one of a number of examples that are particularly pertinent to this paper. This is one of a number of clear examples that emphasises the importance of palaeo perspective as the widespread drying appears to have had a massive human population response that changed the face of the African continent – additional supporting references have been provided here.

Both reviews indicate a more rigorous structure, particularly to the introduction, would provide additional framework to the paper. The introduction has been significantly rewritten developing the text under a series of headings that directly link them to the palaeoenvironmental information and provide a clear structure to the paper. Additional case studies and information has been used to strengthen the paper. All of the technical comments have been dealt with.

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