

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

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### 1. Overall comments

This is an interesting paper that seeks to show how palaeoperspectives can provide insight for sustainable development of ecosystems and landscapes in East Africa. The timescale covered stretches from the last glacial maximum to recent centuries. Long term inferences about climate and ecological change are from microfossil records (pollen, diatoms, midge) are reviewed along with archaeological records and modern projections of climate. The conclusions make a strong case for incorporating palaeoecological information in modern day assessments of sustainability. But paper can be improved greatly. First, the introduction can be strengthened with other passages existing throughout the paper in order to provide a clear structure for the paper. Second,

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only sections 3.1 and 3.2 have titles that define the palaeo information contained within. Other new sections or sub-sections could have titles that directly link to the palaeoenvironmental information base described in the text, eg. local hydrological feedbacks v climate shifts, changing geographic distributions driven by climate, vegetation responses to atmospheric CO<sub>2</sub> levels. Indeed, the introduction would benefit from listing or categorizing the potential palaeo contributions – giving the reader a summary of the paper. Third, where possible these sections would really benefit from the inclusion of more case-studies with more palaeo data shown in figures at the expense of, if necessary, maps of National Parks and climate projections. Fourth, the sections about the future make only implicit reference to how projections are aided by the knowledge from the past eg. developing, constraining and testing models. A suggestion for the authors. A summary figure of timelines of the major palaeo changes for the region might be a challenge to create but would be hugely beneficial and a real milestone.

### 2. Technical/typographical comments

#### Abstract

Overall good but maybe could include examples of the new insight gained

Line 10 add line to explain why this deserves a special place?

Line 12 re-write as ‘a palaeoenvironmental perspective’... as in title.

Line 15 ‘is’ growing rapidly? And ‘based on’ in preference to ‘employing’?

Line 22 considered ‘in order’ to impart?

#### Introduction

Could usefully be re-written: especially making it more explicit with regards elucidating the key questions posed, the structure of paper and the context of needing an improved information based in order to make decisions about sustainable management.

Pge 965

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Line 9 understanding 'of'

Line 13-14 is it the most rapid period of change? Or more likely a period of rapid change which is also (as the next line) implies unprecedented in its nature.

Line 19 – not sure how the '-this not representing ...' clause is meant to be read.

Line 28 'palaeo-perspective'

Page 966

Line 17 define 'recently'

Line 17 this example needs to be more explicit about how the present is informed by the past.

Page 967

Line 23 'forming'

Figure 1 OK

Figure 2 This is not a map of ecosystem distributions. Scales of rainfall and temp need to be close to coloured bars.

Page 968

Figure 3 This is not showing maps of climate. Need to switch Figs 2 and 3 in text – but probably best to introduce ecosystems after climate section not on page 967, line 25.

Line 15 better word than 'strewn'?

Plate 1 Best to have a title. Like 'Examples of East African ecosystems and land use.'

Line 29 remove apostrophe from 'its'

Page 969

Line 24 Plate 1 – add letter of image? And elsewhere.

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Line 28 Sentiment behind polemical statement understood but best to delete – make this a forceful and considered point in conclusions?

Bottom of 969: Much of this could be included in the Introduction where it would greatly strengthen the beginning of the paper. As it is, this summary of ecological issues comes slightly uneasily after the general description of the environment.

Page 970

Good review of past research but the key information and questions provided by and answerable through palae-perspectives are not identified explicitly.

Page 971

Line 2-4 Long sentence needs breaking-up or re-structuring.

Line 5 Figure 4 - label three panels a, b and c and use these in legend and text. Not clear how we should link text here to Fig 4.

Line 10 mentions glacial period but earlier the focus was on last 10000 years.

Line 16 'Tanzania' and '2000 m'

Line 19 Don't follow the explanation here for anomalously low grassland – why does low stature vegetation lead to declines in available moisture?

Line 24 Big jump in time from glacial period to today. OK perhaps if section is sub-titled 'vegetation-hydrological' relationships.

Page 972

Line 2 which is the vision of past responses? The glacial period or the recent deforestation? Why are reconstructions potentially erroneous? No-analogue problem?

Line 4 'holistic' rather than 'wholesome'.

Line 5 'projecting' or 'simulating' better than 'predicting'

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Line 6 spell out LGM

Line 12 Give panel letter for Fig 4. Explain in figure how arboreal percentages decline abruptly at 5500 cal yr BP- Hagenia and Juniperus presumably– but graphical resolution not easy to show this – indeed these appear to decline from well before 5500 cal yr BP – hardly abrupt?

Line 13 How can these form part of wider changes seen some 1500 years later?

Figure 5 - source?

Page 973

Line 5 Good evidence to show this - but the idea of 'how' pristine any of the ecosystems are could be set up as an initial question to try and answer?

How representative are the three pollen data sets shown in Fig 4? Probably need to give English plant names or plant functional types as well as Latin names.

Page 974

Line 5 .. needs re-phrasing.

Line 6 'stark'? Not sure how to interpret this sentence. Do you mean current observable changes or projected changes? Give an example might help for readers unfamiliar with region.

Line 9 Good point to make – but is there some accessible date to show this?

Line 11-16 Yes. And also the importance of identifying the difference between vegetation change associated with changes in local feedbacks (eg. local land use) and regional climate shifts?

Line 20 Does this sentence (beginning 'The impact...') actually add anything to the anecdote – for me it was a distraction from the main point? Maybe use it as a general point for the introduction or discussion about how the climate induced effects on

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vegetation propagate to all sectors of society.

Agricultural transitions The first paragraph all the way to Page 975 line 20 seems to repeat and embellish earlier justifications for using the past - this could all usefully go in the introduction.

Page 975

Line 2 agreed but say why.

Line 5-10 Is this all specific to East Africa? If so, it needs spelling out in more detail.

Page 976

A page and a half without any reference to specific palaeo/archaeo data. These seem to be general points which could go earlier in a section on problems of generating palaeoperspectives.

Line 14 Not 'commuted' surely? Communicated? Or 'represented in the...'

Line 23 – and through to Page 978. Really nice example – but possibly needs to come earlier in section as an example of the ideal palaeoperspective on the modern landscape.

Page 978

Line 8 Figure 4 – add panel letter.

Line 9-12 Sentence ending in Lane 2009 – shift from case-study to generalities spoils the flow of text – but useful introductory material.

Line 15 onwards

Lower half of page again moves to general statements around the theme of adaptation without any pre-empting - this is a section about transitions.

Page 979

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The future of ecosystem services

Lines 6-9 Is the statement about 2C limit needed? Could start with 'Impacts of increasing water stress...' line 9.

Line 14 delete 'of this'

Figure 6 has no letters mentioned in legend

Page 980

Lines 2-12. Might be better to explain the issue first –that the past shows geographic ranges of animal populations have shifted dramatically - then explain how changing geographic ranges in the future will make achieving conservation mandates difficult -with example of zebras showing the difficulties already.

Lines 13-page 981 Line 8 Not clear how palaeoperspective is important.

Fig 7 Choice of colours is counter-intuitive. Wetter-yellow/red. Drier-green/blue.

Page 981

Line 9 – again, start paragraph with statement about a palaeo finding in terms of changes in atmospheric composition has implications..... might be better.

Page 982

Line 8 'coeval'?

Line 8-14 From here to end is very sensible - BUT as a concluding statement needs to be strongly based on evidence shown in text. And this is not always the case.

Line 26 Ostrom

Figure 8 – In legend, need to show where the three pillars are in figure. Need to describe how the figure works – what do the arrows mean – the different colours etc. Original based on analysis in figure or a previously published source?

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Page 984

Line 7 Dearing et al 2007 not best reference for the PAGES programme. Refer alternatively to: PAGES (2009) Science Plan and Implementation Strategy. IGBP Report No. 57. IGBP Secretariat, Stockholm. 67pp.

And science in the SPIS is described more fully in: Dearing, J.A., et al 2006a. Regional Environmental Change. 6, 1-16. DOI: 10.1007/s10113-005-0012-7; Dearing et al 2006b Regional Environmental Change. 6, 115-123. DOI: 10.1007/s10113-005-0011-8; Dearing J.A. 2006. Climate-human-environment interactions: resolving our past. Climate of the Past, 2, 187-203.

Line 11 Which other ecosystem functions?

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