

Interactive comment on “Continuous and consistent land use/cover change estimates using socio-ecological data” by Michael Marshall et al.

Anonymous Referee #4

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Review of “Continuous and consistent land use/cover change estimates using socio-ecological data” by Marshall et al., submitted to Earth System Dynamics

Marshall et al. describe a methodology for predicting land use and land cover type in sub-Saharan Africa from combination of a large set of climate, biological and sociological data. Models are developed for different categories of land cover and the model results are validated against photographic evidence from two data collection campaigns in Kenya. Results show that population density is the best predictor of land use categories in this region and that agricultural lands have expanded over the last 30 years in the study region.

I have a few comments that I hope will be helpful but overall I find the manuscript to be well constructed and the methods to be valid. My major questions are about the

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value of this approach outside of the region of verification and for constructing future projections of land use with uncertainties in population growth.

Major comment:

1. I think whether the relationships derived here between the predictors and the land cover categories are applicable outside of the verification regions is an open question that could be discussed more in the manuscript. At the end of the introduction several aspects of the study region are described that are relevant to the value of the model outside of Kenya. It would be helpful to include some discussion later in the paper (perhaps in section 5) about whether these same aspects (especially the high population density in the most productive areas) are common throughout SSA and whether you expect that the model would apply elsewhere.

Minor comments:

Pg 3, Line 7: I recommend also citing Ward et al. (2014) for a summary of biogeochemical impacts of LULCC on climate.

Pg 3, Lines 11-13: My understanding is that many terrestrial models, for example the land components of the Earth System models used for the Coupled Model Intercomparison Project do include spatially explicit changes in land cover, both historically and for future projections (e.g. Shevliakova et al., 2009; Lawrence et al., 2012). It is possible I misunderstood the use of “land surface model” in this sentence.

Pg 9, Line 9: I think BIOCLIM should be defined here or before.

Pg 11, Lines 15-16: Is there any evidence that using the 1990-2000 population growth/decay statistics gives a reasonable population in 2012? Understanding that the dataset used did not extend past 2000, maybe there is another source of population data that could lend some confidence to this assumption. Especially since the predicted LULCC depends so much on the population density changes.

Pg 19, Lines 2-4: I was confused by the mention of non-tropical latitudes since the

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study region is entirely tropical. Maybe this was included to aid reader understanding of “isothermality” but it might add unnecessary confusion.

Pg 21, Lines 11-13: The decrease in agricultural lands in Kitale

Pg 21, Line 18 to Pg 22, Line 8: This discussion of the difficulties inherent in using historical and projected population density data is nicely done and really lays out the problems with trying to project LULCC into the future with this methodology. This might be a good place in the text to also discuss the applicability of the results to other regions (Major comment #1).

Table 2: I recommend being more specific with the websites referenced in this table. It would be helpful for the reader to be able to find the site where the data are available instead of having to find and follow several embedded links.

Figures 8-9: What about also showing the spatial plots of trends in LULCC observed by the aerial photography and comparing this to the model results, instead of only the scatterplot? This could help demonstrate the locations of any model biases and also give another way for the reader to evaluate the model performance.

References:

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Shevliakova, E., Pacala, S. W., Malyshev, S., Hurtt, G. C., Milly, P. C. D., Caspersen, J. P., Sentman, L. T., Fisk, J. P., Wirth, C., and Crevoisier, C.: Carbon cycling under 300 years of land use change: Importance of the secondary vegetation sink, *Global Biogeochem. Cy.*, 23, GB2022, doi:10.1029/2007gb003176, 2009.

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