

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

**Michael Marshall et al.**

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We would like to thank the reviewer for her/his constructive and comprehensive comments. We have made changes to the manuscript accordingly, which are summarized below. We believe the manuscript is much stronger, but welcome additional suggestions if the reviewer feels it necessary.

### Major Comments

1) Per previous reviewer comments, we have inserted the following into the discussion: “The proposed methodology when applied to other regions of the world will undoubtedly result in a different combination of socio-ecological predictors and functional relationships, because access to land varies across agrarian and non-agrarian societies, so further study is required with observed data to develop region-specific models and

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validate the results for countries in SSA. Kumar et al., 2013, for example, showed that in the United States pre-1900 when the country was largely agrarian and transportation networks were weak, population density and crop area were highly correlated, because crops needed to be grown close to markets. However, as the country became more industrialized and transportation networks improved, farmers moved to more biophysically suitable areas away from city centers, making biophysical determinants of crop area more important than population density in the latter half of the 20th century. Whether the analyses are performed in agrarian or non-agrarian regions, extensive preparation of observation data will be required, because the data used in this study, namely consistent sample area frames at a spatial resolution appropriate for land surface modeling and spanning multiple climatic zones through time, is quite unique.”

#### Minor Comments

- 1) We have inserted the Ward et al., 2014 reference
- 2) We agree that more recent attempts have been made to couple LULCC to land surface models. We have changed the introduction accordingly: “Traditionally, spatially-explicit LULCC was not an input to land surface models, but was instead represented by structural (e.g. leaf area index) or physiological (e.g. stomatal resistance) changes in vegetation. LULCC was then mapped in parallel to characterize these changes. These early attempts have been replaced by land surface models coupled to spatially explicit LULCC (e.g. Shevliakova et al., 2009; Lawrence et al., 2012).” The main point here is that land-air coupling research exists and models do quantify its impact, but LULCC estimates need to be improved in order to better quantify coupling.
- 3) There are other simulated population datasets. We did not use these, because they use different methods based on varying availability of district-level population statistics. That said, we are considering for the SSA paper to use Afripop to estimate the growth/decay constant from 2000-2015. In the discussion we include the following: “Finally, there is no consensus on which population product to use however, in the future,

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other products (e.g. Afripop) should be compared against the product used here, used to adjust the growth/decay coefficient for population density estimates beyond 2000, or combined to make a model ensemble.”

4) Based on a previous reviewer’s comments, BIOCLIM has been defined and properly cited accordingly.

5) Isothermality decreases significantly from the equator- even in Kenya. We have defined isothermality instead as “more pronounced seasons.”

6) We changed to “The only decrease in agricultural lands was in Kitale town (-1.40% per year)”

7) We put the discussion on country and regional-specific differences in predictors and functional relationships just after the major finding paragraphs of the discussion to highlight its importance, since it is a major caveat of the study and was mentioned by each reviewer.

8) We added detailed url’s in Table 2.

9) We included percent agriculture for 1983 and 2012 in Figure 9 (now Figure 10) to illustrate differences between a traditional LULCC study (two time slices) versus a trend analysis of continuous LULCC. The manuscript is already quite large and we feel that adding more figures would be too cumbersome. Especially considering that the data is over multiple (and not only two) years.

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