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Earth System Dynamics Discussions

Interactive comment on "Continuous and consistent land use/cover change estimates using socio-ecological data" *by* 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.

1) We did not discuss the use of more detailed datasets that are certainly available for Kenya, because the intent of the manuscript was to use a rare dataset that to our knowledge is only available in Kenya to develop a LULCC model approach that can be used across SSA for land surface modeling applications. Based on the literature, we believe that the functional relationships developed here will be different than for more developed regions such as North America where arable farmland is more accessible.

We have inserted the following into the discussion: "The proposed methodology when applied to other regions of the world will undoubtedly result in different socio-ecological predictors, because access to land varies, so further study is required with observed data to develop region-specific functional relationships. 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."

2) This is a good observation that was not properly articulated. The bar graphs and Figure 5 essentially show that remote sensing predictors account for more variance, initially, but the incremental (and thus overall) improvement is lower than the non-remote sensing predictors. The non-remote sensing predictors have the additional advantage of being more numerous. We added to the results: "It should be noted in each case however, the highest ranked remote sensing predictors resulted in lower model error than the highest ranked non-remote sensing predictors. The non-remote sensing predictors were more numerous and generated larger incremental improvements that contributed to overall greater predictive power" to the methods to clarify this point. We also changed the second most important finding in the discussion to "2) non-remote sensing predictors outperformed remote sensing predictors due to their number and the incremental improvement in the predictive power of each."

3) The ultimate goal of this model-building exercise is to project land for SSA. This is extremely difficult to do with Earth observation data. That said, we have inserted text in the discussion to address two possible avenues for Earth observation in retrospective analyses: "An analysis of the non-remote sensing and remote sensing predictors together revealed that for agriculture, natural vegetation, savanna, and forest cover, Earth

observation data provided an additional 1-2% explained deviance. If the long-term average remote sensing predictors could be downscaled using MODIS or Landsat data, for example, the explanatory power of non-remote sensing predictors could be further enhanced for retrospective analyses. Another avenue worth exploring involving downscaled long-term average remote sensing predictors could be to evaluate non-remote sensing models." Additional figures are available for the combined analysis, but we did not include them in the manuscript, because remote sensing predictors provided little added advantage and they would have made the manuscript too cumbersome. We did however, include one statistic concerning the added explained deviance worded above.

4) We have changed this to reflect the fact that remote sensing predictors initially explained more variance, but additional predictors added little value when compared to non-remote sensing predictors.

5) We believe the inclusion of the paragraph in the discussion from comment #1 properly addresses the case when regions transition from agrarian to industrial.

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