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Earth System Dynamics Discussions

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Interactive comment

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.

Major Comments

1) We agree with the reviewer that the accuracies are "quite low" compared to high resolution LULC classification approaches. However, when dealing with coarse resolution data, R2's of 0.65 are acceptable from the literature. Per other reviewers' comments, we added a paragraph and major caveat to the discussion, which addresses transferability issues. It will be interested to see in our upcoming paper for SSA to what degree

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this approach will capture agriculture and natural vegetation change. We did not have the data necessary at the time to do a SSA manuscript, but now we do.

2) Based on a previous reviewer's comments, we have added statistics to show that blending remote sensing predictors with non-remote sensing predictors did not change the results much (ΔR2=0.01). The biggest gains actually came from introducing the ISRIC soils data, but we omitted it from the final analysis, because it is a one-time snapshot and soil properties are quite variable. In addition, it adds a layer of complexity that we felt could not be addressed properly in the discussion. As the reviewer suggests, the remote sensing approach taken has been used in previous studies. The temporal signature had to be exploited, because of the lack of spectral information (i.e. we were only using NDVI). As cited (Tian et al., 2015), the reason we used GIMMS 3g over LTDR and other long term coarse resolution remote sensing records is because it is the most appropriate for trend analysis. LTDR is a blended AVHRR and MODIS product. As such, the blending of two different data records leads to artificial jumps in 2000, which can have a significant impact on trends. Perhaps this issue has been addressed in the new LTDR Version 4. At the time the analysis was performed however, version 4 was not available. Based on previous reviewer comments, we have deemphasized non-remote sensing predictors over remote sensing predictors, addressed the real benefit of non-remote sensing predictors more clearly, and highlighted important opportunities for both. We believe the real opportunity is with downscaling.

3) Indeed, the relatively poor performance of the remote sensing predictors lies with the problem of heterogeneity and we discuss this. However, we did add "If the long-term average remote sensing predictors could be downscaled using MODIS or Landsat data and then aggregated to 5x5 km2 resolution with distribution moments as predictors, for example, the explanatory power of non-remote sensing predictors could be further enhanced for retrospective analyses. Another avenue worth exploring could involve using downscaled long-term average remote sensing predictors to develop 5x5 km2 probabilities as in the Pengra et al., 2015 dataset to evaluate the non-remote sensing

models proposed here."

Pengra, B., Long, J., Dahal, D., Stehman, S.V., and Loveland, T.R., 2015, A global reference database from very high resolution commercial satellite data and methodology for application to Landsat derived 30m continuous field tree cover data

Minor Comments

1) We have added at various points in the discussion concerns about the complexity of interactions and feedbacks between the predictors and LULCC. Most notably we observe, that 50-100 year projections may not be realistic as SSA transitions from more agrarian (population driven) to industrialized (ecologically) driven crop area.

2) We have added to the discussion that "As seen in the functional plots, low populated areas with more temperature seasonality, or inter-annual variation, and lower bio3.d (isothermality) tended to have higher proportions of natural vegetation (savanna and shrubs). Isothermalitiy is the ratio of mean diurnal temperature range (bio2.d) to the temperature annual range (bio7.d), which is the difference between the annual maximum and minimum temperatures." Bio14.d is already defined in Table 2 and is self-explanatory: Precipitation of Driest Month.

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