Earth System
Dynamics
Discussions

Interactive comment on "A global assessment of gross and net land change dynamics for current conditions and future scenarios" *by* Richard Fuchs et al.

Richard Fuchs et al.

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Comment_R2#1 Review of ESD-2017-121: "A global assessment of gross and net land change dynamics for current conditions and future scenarios " The manuscript by Fuchs et al extracts the gross and net land changes using remote sensing products at the continental scale to create a new global gross and net land change dataset. Based on this dataset, authors find that the gross land changes within 0.5-degree grid cells were substantially larger than the net land changes in all parts of the world. When applied the present day gross and net land changes relationship to estimate in a future scenario, they find that the gross land changes consideration led to approximately 50%

more changes globally compared to a net land change representation. The authors show that gross land changes are most important in heterogeneous land systems like shifting cultivation, smallholder farming, and agro-forestry. This study contradicts earlier studies, which assumed gross land changes to appear in shifting cultivation areas only.

I found that the paper is well written, the results are novel and have important implications for the studies that do not consider gross land use changes. I recommend acceptance of the paper after addressing the following concerns:

Response_R2#1 We thank the reviewer for the positive and constructive comments and suggestions. Please see the detailed point-by-point responses below.

Comment_R2#2 1) Page 6, l25: I do not really understand what do you mean by 'intersected all changes'?

Response_R2#2 We will remove this sentence to avoid confusion.

Comment_R2#3 2) Fig.3 forest over India?? I am surprised to see there is no forest over Southwest coast of India (so-called Western Ghats of India)! What resolution is this data! You mention this map is based on census and remote sensing data, then I do not really understand (mostly croplands). For example see the land use land cover map for (the year 2005, 100m resolution) India (https://daac-news.ornl.gov/content/land-use-and-land-cover-india)

Response_R2#3 We agree with the reviewer that it is hard to see in the image. The region mentioned by the reviewer is mostly classified as forest mosaics in the land system map (purple colors), which consist of a considerable amount of forest in this region (>30%). Given that many mountain ridges are often grasslands rather than forest, the LS map represents this as extensive mixed classes. The forest fractions in the map are based on the 500m Vegetation Continuous Fields product by Hansen et al. (2003). Grassland and cropland fractions were derived from Ramankutty et al. (2008)

at 5-arc min. spatial resolution. The approach for the LS map is explained in detail in van Asselen and Verburg (2012), Global Change Biology.

Comment_R2#4 3) I face difficulty in understanding how you derive gross/net land changes for the future scenario at the methods section. You derive empirical relationship from observed present-day data–! Then used in this empirical relationship in CLUMondo model to derive for the future scenario??? I feel figure 4 is not clear enough to convince the readers the method of deriving gross/net change ratios.

Response_R2#4 We will indicate more clearly in figure 4 that the model gross/net changes are used at the spatial resolution of the model (9.25x9.25 model) and the empirical data were used to derive changes at the sub-pixel spatial resolution through more consistency in terms. For the scenario, we assumed that for a particular land system historically observed changes would be valid also for future dynamics within this land system.

Suggested change: We changed figure 4 accordingly.

Comment_R2#5 4) How do you deal with very small fractions in the denominator while calculating gross/net ratio? Worth mentioning in the discussion section.

Response_R2#5 Good point! We will add some explanation on that in the text.

Suggested change: "Occasionally it happened that the net change fraction was very small and let to very high gross/net ratios. When these small fractions of net change led to a gross/net ratio larger than 1000% we excluded these numbers from our analysis." (pg. 18, line 8).

Comment_R2#6 5) Worth mentioning 'how you estimate the accuracy of the datasets'.

Response_R2#6 We will make clearer that we did not estimate the accuracy of the datasets ourselves. The available accuracy assessments were made by the individual institutions in their data documentation. If no assessment was available at all (e.g. for Globeland30), we focused on available case studies (page 4). Additionally, we

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highlighted a visual comparison of all overlaying data set (figure 2) to compare general patterns of land cover classes.

Suggested change: "Thirdly, we used available accuracy assessments of the datasets for individual years, made by the individual institutions, only including those with reasonable quality (around 80% or higher), a sufficient sampling scheme and reference data." (pg.4, line10)

Comment_R2#7 6) Could you provide expansion of the 'LNCD', CORINE, RCMRD, MOFOR in the caption of Figure 1?

Response_R2#7 Will be included.

Comment_R2#8 7) At 2nd line in the first paragraph of page 9: expand LC typo: remove repeated 'that' in the first line of Conclusions section.

Response_R2#8 Will be changed accordingly.