

Comment on essd-2022-351

Anonymous Referee #1

Referee comment on "Annual emissions of carbon from land use, land-use change, and forestry from 1850 to 2020" by Richard A. Houghton and Andrea Castanho, Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2022-351-RC1>, 2022

This manuscript describes a dataset of carbon emissions from historical land use, land-use change, and forestry, presented nationally, regionally, and globally. The dataset is an update to a previously published dataset, and incorporates new data from FAO, along with new model assumptions and processes. The paper is well-written and presented logically.

In addition to describing the specific details and improvements of the dataset, the manuscript has a great description of the many sources of uncertainty in datasets of land-use and related emissions, both generally and for this particular dataset. Specifically, the authors explore how to use and interpret the data from FAO that indicates the area of tropical Forests Converted to Other land (FCO). They employ three alternative interpretations of FCO, with shifting cultivation being the default assumption, and compare the modeled results of each assumption. This is a valuable discussion, along with the discussion of uncertainty in land-use emissions that arise from limitations of limitation of satellite data, and uncertainty that arises from alternative definitions of land-use change emissions and which processes are included.

Overall, this manuscript provides a good dataset description and also provides an excellent discussion of land-use emissions and their related uncertainty. I have a few comments and suggestions for the authors (listed below) but otherwise recommend it for publication.

- The apparent mismatch between net loss of tropical forest and the net increase in cropland and grazing land is described as "forests converted to other lands". However, perhaps it is also possible that the forest, cropland, and grazing data provided by FAO are just not consistent with one another, and that the differences between net forest loss and net agricultural gain represent the uncertainty or error in the reporting of land-use data to FAO? The reporting of data to FAO also happens infrequently (I think every 5 or 10 years) so it is also possible that the timing of changes in the various land-use categories are not being reported on the same time scales. Has this been considered by

the authors?

- Why were changes in fire management considered in the model for only the USA and not for other countries?
- Why did the area of secondary land used for wood harvest increase in this version of the model code? (Section 2.3.1 and Section 3.1). I can see that this would make a difference to the recovery (and gross uptake of carbon) but it wasn't clear in this section why this change to secondary wood harvest areas had been made in the first place.
- Line 406: the cited publication (Friedlingstein et al. 2022) is for the 2021 Global Carbon Budget not the 2020 global carbon budget.
- Fig 1: the lines are very thin and hard to read
- Table 1: what is meant by the "peat-2020" column?
- Fig 2: the gray lines and black lines and mostly indistinguishable on my screen
- Fig 3: are the region labels used in this figure (and elsewhere in the manuscript) defined somewhere?
- Fig 4: lines are too thin, black lines look gray
- Figs 1, 2, and 4 present similar information, although each is slightly different in order to compare specific changes to model assumptions or data. It would be helpful if the figure captions could more clearly capture or describe the intended message that each figure is trying to convey, to help separate these figures from each other for the reader. In addition, some of the lines in these figures have the same legend labels (e.g. "this study FAO 2021 recovering") but show different data. Is that because some of these figures include emissions from peat, while others don't? Or is there another reason for these differences?
- Table 2: the caption indicates that emissions for 2 different time periods are included (2011-2020 and 2011-2015) but the later doesn't appear to be shown
- Figure 9: the figure shows emissions from different types of land-use. However, it is not clear if "crop" or "pasture" are emissions from the use of that land or the land-use conversion from some other land to cropland or pasture (which would be a land-use change).
- Figure 10: font is too small to read
- Table 4: I have the same question as above r.e. types of land use. Also why are some (many) numbers bold?
- Figure 13: the lines are very fine and difficult to read