

## ***Interactive comment on “A high-resolution and harmonized model approach for reconstructing and analyzing historic land changes in Europe” by R. Fuchs et al.***

**Anonymous Referee #1**

Received and published: 2 December 2012

Fuchs and colleagues develop a contemporary (1950-2010), spatially explicit (1km) land cover reconstruction for the European Union and Switzerland. In pursuit of this product, the study explores several critical issues in the context of land use reconstructions, namely spatial resolution and validation. Major improvements in the spatial detail of historic land use reconstructions arise from 1) the method (in particular, working backward from conditions circa 2000, including satellite-based land cover information), and 2) the quality and consistency of survey information on net land cover changes for Europe.

I am concerned that the paper focuses heavily on the trends in land cover across

C6132

the region. While interesting, and possibly traceable to specific national or regional circumstances, these values are derived entirely from census data at a national scale. Sections 3.1 and 4.1 are therefore quite speculative. In contrast, the ability to reproduce reasonable patterns for changes in land cover is more novel. This study is primarily about spatial allocation, not modeling land use changes. The hindcasting approach in this study is particularly apropos for Europe, a region with a long history of settlements and agricultural production.

My second concern is with the assertion that the HILDA product is more suitable for studies of emissions from land use change than previous reconstructions (sections 4.3 and 4.4). As the authors admit, net land use changes differ significantly from gross land use changes (perhaps by 50-100% in the case of Europe, Pg. 14846, Line 15-18). This missing dynamism is critical for greenhouse gas emissions estimates. I would encourage the authors to indicate which specific applications would see a meaningful improvement in the ability to account for carbon or other greenhouse gas emissions using HILDA. This is especially important as the time period for the HILDA product encompasses the satellite era, and many reporting mechanisms for greenhouse gas emissions at the national or regional scale would be better served with direct estimates of contemporary changes.

Specific comments: 1. Abstract and Introduction: Land use change does not currently account for 30% of carbon emissions from human activity. The core concept, as stated later in the paragraph (the relative contribution from land use change continues to shrink as fossil fuel emissions grow) is sound, and does not diminish the need to characterize land use dynamics of large regions/long timeframes. I would encourage the authors to avoid the 30% statement (see van der Werf et al., 2009), especially as this study finds a net increase in forest cover over the study period.

2. I agree that the spatial allocation of a settlement category is important, and the methods are sound. However, this category accounts for a small (and diverse, in terms of carbon stocks) fraction of total land area in Europe. Similarly, the statements through-

C6133

out the manuscript about the importance of other lands (for 100% coverage) could be toned down, as the paper actually excludes other lands from change estimates (Pg. 14833).

3. This analysis identifies, but not does not confront, one important inflection point in global land management: the green revolution after the second world war. Is this advantage for HILDA, which begins in 1950, a disadvantage in the context of nesting these results with other global or longer term land use reconstructions? How to harmonize the large changes in cropland extent in 1950, both in terms of total extent (figure 8) and spatial allocation (figure 7)?

4. Why are the validation R2 values higher in 1950 than in 1990? Might this relate to the stability of cover types (as discussed in validation efforts), such that backing up to 1950 involves fewer change allocations?

5. Word choice: ("demand") on pg 14832, 24-26 is confusing term.

6. Pg 14841. Urbanization, if that is the driving factor behind increasing population, involves two changes (from-to). How do these coupled changes influence the overall results?

7. Limitations: It would seem as though other satellite data could help provide landscape information, e.g., early Landsat data. This might be an issue to explore in the discussion section on methods and potential improvements for contemporary land use reconstructions.

8. How important are other land use transitions (such as logging) that do not change land cover but do impact greenhouse gas emissions studies? Time since clearing?

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Interactive comment on Biogeosciences Discuss., 9, 14823, 2012.