**Earth System
Dynamics
Discussions**

Interactive comment on "Implications of accounting for land use in simulations of ecosystem services and carbon cycling in Africa" *by* M. Lindeskog et al.

M. Lindeskog et al.

mats.lindeskog@nateko.lu.se

Received and published: 3 May 2013

Answer to Anonymous Referee # 1:

We would like to express our thanks to the editor and the referees for their careful reading of our manuscript, and the constructive suggestions for improvement. Below we list the changes we have made in response.

1) p 238 line 23: is it your assessment or can you provide a reference supporting "especially in the lower latitudes"

Page 3: Added the IPCC AR4 WG2 report, Climate change 2007: Impacts, Adaptation

and Vulnerability, . . ., chapter on Food, fibre and forest products, which should cover the lower latitude crop production sensibility to climate change (Easterling et al., 2007).

3) p 245 last paragraph: so this is a transient dataset of actual crop pfts? Please explain more explicitly because I'm not aware of such a dataset existing, yet. I think you should document in more detail how you created it.

We have added more information on the land cover database used in the paper, including maps of cropland fraction, pasture fraction and irrigated fraction of gridcells in Africa. These maps are placed in the Appendix. We also more explicitly describe how the database was constructed.

Changed text in 2.2: "The historical cropland data set for 0.5o gridcells used in this study was an adaptation by Bondeau et al., (2007) of the cropland fraction for the period 1901-1992 (Ramankutty and Foley, 1999), the distribution of different crops for 1990 (Leff et al., 2004), the pasture fraction of 1970 (Klein Goldewijk and Batjes, 1997) and the irrigated agricultural fraction for 1995 (Döll and Siebert, 1999) (Appendix A). A simplified land cover change model was used by Ramankutty and Foley to extend the 1992 cropland cover, derived from satellite data calibrated by cropland inventory data, back in time. They used historical national and subnational cropland inventory data and assumed the cropland spatial distribution within these political units to be constant (Ramankutty and Foley, 1999). Bondeau et al. (2007) determined the gridcell pasture fraction after comparing the initial cropland fraction and the "grass and fodder" class of the HYDE data set for 1970 (Klein Goldewijk and Batjes, 1997). Cropland was assumed to expand only into natural vegetation and abandoned cropland was assumed to revert into natural vegetation. The historical cropland fraction was used for the 1901-1992 period and kept at the 1992 level for the rest of the simulation. The relative distribution of different crops (translated into crop PFTs) for 1990 (Leff et al., 2004) and the pasture fraction of 1970 (Klein Goldewijk and Batjes, 1997) for the gridcells was used for the whole simulation period. Irrigation was assumed to occur only for rice in 1901 and then linearly increase to the 1995 value following the linear

trend for global irrigation (Evans, 1997). The irrigated fractions of the different crop pft:s were derived by distributing the irrigation according to a priority list, mainly from European agricultural practices (Bondeau et al. 2007)." 4) p 246 line 5: "only one patch" Last mention of this concept in line 15 of p 241, I think. If so, may help to send the reader back to that sentence for context.

Added "see section 2.1"

5) p 248 line 22: "irrigated ...(Fig. 5)" is the same thing as precip dependent sowing? Is this one of the runs in Table 4 or additional? To this point are you just comparing Runs 1 and 2? The text is confusing here, because the alternative sowing date calculation of irrigated crops (precipitation-dependent, in contrast to the default temperature-dependent) was originally mentioned only in the caption to Figure 5 caption, and very briefly in the methods section. In the revised manuscript text has been added. The comparison of FPAR levels in the text only refers to runs 1 and 2. Crops were always irrigated in the phenology simulations according to the database. Added text in 3.1: "An alternative sowing method for irrigated crops (precipitation-dependent sowing) improves the timing of the growing season in Egypt, resembling one of the two observed growing periods (Figure 5)."

6) p 250 line 22: "is explained by..." suggesting that it's wrong?

The original text was unclear. We simulate temperate cereals, not wheat. This means that "the temperate cereals" PFT is not suitable for simulating wheat that is reported to grow at tropical sites, which is why the 15 degree upper limit for the coldest month was used (this is actually an error in the text, which says 10 degrees). Reported wheat areas in tropical African countries are small. Changed text in 2.1: "For temperate cereals, an upper temperature limit of 15°C for the coldest month for growth is set to avoid growing in tropical climates, following Bondeau et al., 2007." Additionally, we added to 3.3 "Temperate cereals were not modelled in many of the countries that report the cultivation of these crops, because of the upper temperature limit in the model (see

Methods), but none of these belonged to the countries with the largest reported wheat area. In the remaining 9 countries, all showed modelled yields equal to or higher than reported yields. Moreover, we removed the countries in Fig.8 where temperate cereals were disqualified and added text to the caption: "For wheat, modelled temperate cereal yields was compared with FAO wheat yields. Countries where temperate cereals could not grow because of the upper temperature limit are excluded from the scatterplot. In most of these countries, reported wheat-area overall is small" We also changed the pft name "millet" to "tropical cereals" in the text (page 11).

7) p 253 lines 7-8: "higher" seems strange to me, esp. together with "release"

To clarify, we added the NECB sign convention to the text (negative for carbon uptake) (was previously only in the figure legends). Added text to 3.4: "Positive values represent a net flux to the atmosphere, negative values a flux into ecosystems."