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Interactive comment on "On the rebound: soil organic carbon stocks can bounce back to near forest levels when agroforests replace agriculture in southern India" *by* H. C. Hombegowda et al.

Anonymous Referee #1

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General comments:

In this article the author presents an analysis of soil organic carbon stock changes associated with conversion from forest or agriculture to agroforestry. They identify significant predictor variables of SOC stock and present a large and useful data set that highlights some of the impacts of agroforestry on carbon stocks.

In addition to specific comments below regarding soil texture, the nature of the precipitation that falls in this region may have significant impacts on carbon cycling. Mean annual precipitation, although a simple variable available to measure at many sites,

does not always capture the underlying drivers for soil carbon cycling, see Knapp et al. (2002). Overall this manuscript presents interesting information and analysis and after addressing minor comments, is suitable for publication in SOIL.

Specific comments:

Experimental Design: Section 2.3 The author states that no wood is removed from the forest. Is there any history of fire in these forests? If so, is there any evidence of char or ash in the soils once they undergo conversion to agriculture/agroforestry?

Results: Section 3.1 The author assumes that land use change does not affect soil texture, but there appears to be evidence to the contrary. If across plots there is a +2.3(+-0.4)% and a -5.5(+-0.5)% change in clay content with the conversion from agriculture to agroforestry, and the conversion from forest to agriculture, respectively, this appears to be a significant effect on soil texture. The author contradicts their own assumption by highlighting the importance of clay fraction as a predictor of SOC stock (Table 2). Also, changes in soil texture, particularly in clay content, can have significant impact on the soil water retention (Gupta et al 1979).

It would be helpful in this section to see the results of the t-test for the 10-30cm clay content in the appendix.

It is not stated clearly whether the difference in clay content occurs throughout the profile, but if the difference is within the upper 10cm it is likely that change to/from tillage, and aeolian and hydraulic erosion/deposition are all potentially significant drivers of soil texture changes and cannot be discounted. If the upper 10cm of the soil with 1600 kg m-3 bulk density and 20% clay content by mass has a change in 5% of the clay content, this results in a change of 16 Mg ha-1 of clay. If the potential for this clay to associate carbon is assumed to be 3.9% by mass (Gonzalez et al 2003) that results in a potential change of 0.480 Mg ha-1 of carbon associated with the clay fraction when these clay particles form aggregates. This amount of carbon, although below the error of 0.7-1.6Mg ha-1 associated with SOC stock changes in the upper 10cm (Figure 3), is still worth mentioning as a part of the mechanism for change in SOC stock. It is also worth noting that loss/gain of the clay fraction could contribute more significantly to the amount of carbon stored in areas of higher erosion/deposition due to its outsize role in physical and chemical stabilization of organic matter.

Discussion Section 4.2 P 883 lines 17-18 The author states that erosion is of little importance. Judging from the losses in clay fraction from the soils upon land use change, this is not necessarily an aspect of land use change that can be overlooked at all sites. Dourte etal (2012) reports rainfall rates for Andhra Pradesh and has made calculations showing that high rates of runoff are possible. Using Dourte's data for monsoonal rainfall intensity as a proxy for nearby areas, of similar rainfall quantity, runoff, and therefore erosion of surface fines and associated fine-grained surface organic matter cannot be dismissed, especially for the agricultural sites without the protection of a closed canopy for diffusion of the rainfall energy. Including this in the discussion would also help make this data more interpretable in areas where steeper slopes and high rainfall energies are present.

Technical Corrections: P872 line 4: remove "however"

P 874 Line 16: "stocks" should be "stocks"' or "...and changes to SOC stocks along a forest..."

P880 line 19 "...soil SOC..." should be "SOC"

P876 lines 8-9 "cinnamom" should be "cinnamon"

Dourte, D., Shukla, S., Singh, P., & Haman, D. (2012). Rainfall intensity-duration-frequency relationships for Andhra Pradesh, India: changing rainfall patterns and implications for runoff and groundwater recharge. Journal of Hydrologic Engineering, 18(3), 324-330.

Gupta, S., & Larson, W. E. (1979). Estimating soil water retention characteristics from particle size distribution, organic matter percent, and bulk density. Water Resour. Res,

15(6), 1633-1635.

Knapp, Alan K., et al. "Rainfall variability, carbon cycling, and plant species diversity in a mesic grassland." Science 298.5601 (2002): 2202-2205.

Interactive comment on SOIL Discuss., 2, 871, 2015.