

***Interactive comment on* “Effect of deforestation and subsequent land-use management on soil carbon stocks in the South American Chaco” by Natalia Andrea Osinaga et al.**

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The manuscript presents the results of changes in soil C stocks, bulk density, mean weight diameter and penetration resistance along a land use gradient in the Chaco of Argentina. Results are broken down to several soil layers down to 1 meter and different soil size fractions. Soil C stocks decrease from forest over pasture to long-term arable cropping with no difference between the two ages of the cropped sites.

General comments: The authors composed a compact manuscript with overall good quality. It is easy to read and mostly easy to comprehend. The concept as such is not new (tracking soil-C stock changes along chronosequences) but the compiled data

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present another reference data set for land use changed induced soil C losses in a sensitive and crucial region of the world and is definitely suitable to publishing in SOIL. Objectives are clearly formulated. However, since the results are not unexpected under the given environmental changes I recommend to further improve the presentation of the results and the discussion and relate the results to similar studies (see suggested references below). The significance of the manuscript would benefit from the breakdown of results to respective soil parameters (see detailed comment below). Although all sites are Haplustolls and Argiustolls and respective soil parameters are given in Table 1 and they are similar enough to classify them as one for the results' interpretation, it would be good to see the actual variability of the soil parameters (at sampled depth possibly) at the sites and how the soil C stocks and BD correlate with these. The soil parameters per sites could be given in the appendix and Table 1 then lists mean values and respective standard deviations. The discussion of MWD and penetration measurement results need to be improved in respect to an overall story line and the significance of the here presented results for land management and possible human interventions to improve soil quality. Overall, references to other studies where soil C-stock changes were analysed are missing, e.g. the studies of Johan Six, Karoline Deneff or Balesdent should be included in respect of SOC distribution in different soil size fractions, e.g.:
• Balesdent, J., et al. (1998). "The dynamics of carbon in particle-size fractions of soil in a forest-cultivation sequence." *Plant and Soil* 201: 49-57.
• Six, J., et al. (2000). "Soil Structure and Organic Matter: I. Distribution of Aggregate-Size Classes and Aggregate-Associated Carbon." *Soil Science Society of America Journal* 64(2): 681-689.
• Deneff, K., et al. (2007). "Microaggregate-associated carbon as a diagnostic fraction for management-induced changes in soil organic carbon in two Oxisols." *Soil Biology and Biochemistry* 39(5): 1165-1172.

Specific comments: Lines 22-24 (abstract): This sentence suggests that the study investigated the effect of pasture as an intermediate phase during otherwise continuous cropping which is not true. Same formulation is used in the conclusions and should be adjusted. Please reference Mollisols, Haplustolls and Argiustolls as classified ac-

cording to the USDA soil taxonomy or other but consistent. Page 3, line 14: of how many individual samples consisted one composite sample? Please specify. Page 4, line 5: Please elaborate shortly on the MWD-method, describe the method and how its specification makes it suitable for its designed purpose here. Please explain for what purpose the method is applied here, also for the penetration analysis. Please describe more carefully the sampling design and how “situation” (page 4, line 6, page 3, line 14) and “plot” (page 4, line 7) relates to each other. Page 4, lines 6-9: I do not understand why the sampling of penetration resistance and soil water content is not consistently sampled although the direct relation is explicitly mentioned. Please explain e.g. why the two samples of soil water content is sufficient in contrast to the penetration measurements every 5 cm. Page 4, line 14-16: Pasture C also decreased sig. in the layer 60-80 and increased sig. in layer 80-100. Please elaborate and discuss. The latter maybe due to the higher C inputs of grass roots in lower layers. Swap paragraphs 2 and 3 of the results and discussion section to keep the topics of SOC stocks versus SOC fractions apart. Page 4, line 21: Replace “treatment” with land use type or similar. Page 5, line 1-2: Add the soil depth for which the 36 and 53% soil C reductions is representative. For the discussion on the change of C in different soil size fractions check the papers of Balesdent at al., e.g. Balesdent, J., et al. (1998). "The dynamics of carbon in particle-size fractions of soil in a forest-cultivation sequence." Plant and Soil 201: 49-57.

Page 5, lines 12 – page 6, line 2: The discussion of BD values is a bit weak and not very conclusive. I suggest to at least adding the soil parameter description along the profile and discuss how soil texture could be related to the different BD values.

Page 6, lines 5-12: It is not clear what message the authors want to convey here and since the MWD-method has not been properly introduced it is difficult to follow a story line here. Page 6, line 19: Please add the R²-value and p-value of the negative correlation (possibly in the graphs of Figure 3). Page 6, line 19-26: Here, only the results a presented with no explanation or discussion. Please explain the significance

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of the different penetration levels in respect to something, e.g. root growth, and relate the results to findings of other studies.

Technical corrections: Page 3, line 14: I suggest to replace “In each situation” with “at each site”.

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