

## ***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.***

**Natalia Andrea Osinaga et al.**

alvarezc@agro.uba.ar

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Response to Referee Comments:

General comment: Reviewer: 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.

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Authors: Haplustolls are dominant soils under forest and pasture management., while Hapludolls and Argiustolls are equally represented in cropped sites. Soil particle size distribution in all sites was only evaluated for the 0-20 cm layer (new Table). Soil BD was highly correlated with SOC ( $r = -0.9$ ;  $p > 0.0001$ ).

Mean values and standard errors of soil particle size distribution in the 0-20 cm layer for different land uses.

See New table as an attach file in Supplement.

Reviewer: Line 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.  
Authors: We suggest (Abstract): “The permanent pasture of warm season grasses allowed to sustain higher C stocks than cropping systems and so could be considered a sustainable management practice”. (Conclusions) “Permanent pasture of warm season grasses proved to be a sustainable practice to mitigate C stock loss compared with cropping systems”.

Reviewer: Please reference Mollisols, Haplustolls and Argiustolls as classified according to the USDA Soil Taxonomy or other but consistent.

Authors: The Mollisol column should be deleted in Table 1 (since no other US Soil Taxonomy Soil Order was studied) and keeping the references to subgroup according to USDA Soil Taxonomy.

Reviewer: Page 3, line 14: of how many individual samples consisted one composite sample? Please specify. Authors: A composite sample built up from 4 subsamples.

Reviewer: 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.

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Authors: We suggest:

Aggregates of 3 to 5 mm in diameter were dried at 40 ° C for 24 hours and then subjected to three pre-treatments: fast wetting of air-dry aggregates with distilled water, wet agitation (previously treated with ethanol) and low wetting (capillarity with distilled water). After applying these pre-treatments, the distribution of the aggregates according to their size was determined using a series of sieves (0.05 mm, 0.1 mm, 0.2 mm, 0.5 mm, 1 mm and 2 mm). The aggregate mean weight diameter (MWD) for each pre-treatment was calculated as an index of the structural stability obtained as the algebraic sum of the percentage of the total mass of soil retained in each sieve, multiplied by the opening of the adjacent sieves. The MDW for each three pre-treatments was estimated and also an integrated value of MDW was calculated.

Erosion and compaction are the main soil degradation processes in the studied region. Soil MDW index was found to be conversely related to soil susceptibility to erosion. Soil penetration resistance allows characterizing soil compaction derived from machinery transit and animal trampling.

Reviewer: 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.

Authors: We suggest changing "situation" or "plot" denominations by "site". We sampled 32 sites, eight by each management studied categories.

Reviewer: 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.

Authors: Soil penetration resistance was determined up to 40 cm in each 5 cm soil layer. Soil water content was only determined for the 0-20 cm and 20-40 cm layers. So, the relationship between soil resistance and water content was constructed by

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integrating soil penetration resistance data for 0 to 20 cm and 20 to 40 cm layer depths.

Reviewer: 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.

Authors: Already discussed in page 4 lines 17-19 .

Reviewer: Swap paragraphs 2 and 3 of the results and discussion section to keep the topics of SOC stocks versus SOC fractions apart. Authors: Agree.

Reviewer: Page 4, line 21: Replace "treatment" with land use type or similar. Authors: Agree. We can change to land uses.

Reviewer: Page 5, line 1-2: Add the soil depth for which the 36 and 53% soil C reductions is representative. Authors: for 0-20 cm depth.

Reviewer: For the discussion on the change of C in different soil size fractions check the papers of Balesdent et 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. Authors: Agree. Our results are similar to those of Balesdent et al. (1998), who found that the total C contents of soils decreased rapidly in the first seven years of cultivation and more slowly after and the decrease affected mostly the coarse CPC fractions. Balesdent, J., Besnard, E., Arrouays, D., Chenu, C. The dynamics of carbon in particle-size fractions of soil in a forest-cultivation sequence, *Plant and Soil*, 201, 49-57, 1998.

Reviewer: 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.

Authors: As mentioned above, soil texture for all studied sites was only determined in the 0-20 cm layer. Soil SOC vs. BD relationship was also described before.

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Reviewer: 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.

Authors: We added a complete the description of the Le Bissonnais method for aggregate stability in the Materials and Methods section.

Reviewer: Page 6, line 19: Please add the R<sup>2</sup>-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 of the different penetration levels in respect to something, e.g. root growth, and relate the results to findings of other studies.

Authors: Penetration resistance at 0-20 cm depth showed a negative correlation with SWC ( $r = -0.72$ ,  $p < 0.0001$ , Figure 3 A). At a greater depth (20-40 cm), no correlation was found between those variables ( $p = 0.32$ , Figure 3B). The practical significance of the values of PR were already explained and discussed in Page 6 line 25-26.

Reviewer:

Technical corrections: Page 3, line 14: I suggest to replace "In each situation" with "at each site". Authors: agree.

Thanks for you comments,

Please also note the supplement to this comment:

<https://www.soil-discuss.net/soil-2017-34/soil-2017-34-AC1-supplement.pdf>

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Interactive comment on SOIL Discuss., <https://doi.org/10.5194/soil-2017-34>, 2018.