

Interactive comment on “Variation of soil organic carbon, stable isotopes and soil quality indicators across an eroding-deposition catena in an historical Spanish olive orchard” by José A. Gómez et al.

Anonymous Referee #2

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General comments

This paper focuses on the impact of long-term erosion and deposition processes on different soil parameters, especially bulk soil organic carbon and its fractions, within an historical olive orchard in Andalusia, Spain. The purpose of this study is worthy giving the importance of olive orchards and intense erosion processes in Mediterranean region. The soil parameters used to illustrate the impact of land use and erosion-deposition processes on soil quality have been well chosen. However, I have many concerns about the methodology, the data analysis, and the structuration of the

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manuscript.

Different points of the ‘materials and methods’ section should be completed and more detailed as the sampling method and the method used to calculate the Corg stocks. Also, how the samples of the reference site were used in the data analysis is fuzzy to me. You’ll find my related questions/requests in the specific comments below.

Whereas the authors chose well the parameters to study here and gather an interesting dataset, this latter seems insufficiently analyzed. I agree with referee #1, the authors should dig a bit further and try to better synthesized the results via fewer but more synthetic figures. Moreover, I have some serious concern about the way the Corg stocks and saturation capacity have been computed and treated.

The authors could review the ‘results’ and ‘discussion’ sections accordingly to new data analysis and figures. Please, could you better structures these sections and add sub-titles?

Please, find some specific comments and technical corrections below.

Specific comments

§2.1 ‘Description of the area’

As the study focuses on an erosion-deposition soil catena, an elevation map of the olive orchard or a topographic profile of the sampled transect locating the soil profiles could be appreciated.

§2.2 ‘Soil sampling’

The authors specified in the text that the reference site was sampled per 5 cm increments whereas the olive orchard was sampled per 10 cm increments. How did the authors compute values of soil parameters in reference site for the 10 cm increments?

All the results presented in the results section concerned the 40 first cm of soil. The reference site was sampled ‘until bedrock was reached (i.e., 0-5, 5-10, 10-15, 15-20cm)

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and when possible... '(l.119-120). Does it mean that the number of sample by 10cm increment in reference site is not constant? If the bedrock can be reached at 20cm within the reference site, what are the implications for the olive orchard especially in eroded areas? What are the implications on the rock fragment content in the samples and the computation of the Corg stocks?

Could you specify somewhere what are the final numbers of values analysed by 10cm increments in the reference site and in the olive orchard please?

The sampling was performed by a mechanical soil core. Was it a percussion drilling machine? Was there any soil deflection/compaction of the samples due to the mechanical drilling, i.e. was there any consequence on the depths of the soil increments?

The Corg stocks were calculated in the study. How exactly? Did you assess the soil bulk density based on the volume and mass of the soil increments? What about the rock fragments?

§2.3 'Physico-chemical analysis'

Corg concentration were determined according to Walkley and Black method. Did you apply a coefficient of correction to the raw data in order to take into account for the incomplete oxidation? This correction factor may vary from 1 to 1.6 depending on land use, soil texture, organic matter quality, sampling depth or climate. You compare two sites with different land uses, texture and organic matter quality (as highlighted by the fractionation results), and different depths.

You determined the theoretical values of stable carbon saturation based on the soil particle analysis. Could you specify exactly which model you used, with the values of the parameters, please? (See my comments below concerning the results section).

§3 'Results' l. 197-199: A more correct way to compare soil Corg stocks between different landuses is on equivalent soil mass.

l. 200-204: did you invert in the values of texture distribution between the reference

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and olive orchard sites? If you have estimated the theoretical values of stable carbon saturation based on the content of particles $<2\mu\text{m}$ (l. 205), the olive orchard should have a higher potential than the reference site according to the clay contents proposed here, i.e. 41 and 30% in the orchard and reference site respectively. Concerning the values of theoretical stable carbon saturation, could you precise the model used to compute them please? The values you proposed (i.e., 1.94 and 1.15%C; l.205) can't be achieved based on the model a proposed by Hassink & Whitmore (1997) in the Table 4.

§4 'Discussion'

l. 276: the value is 1.19 or 1.15%C as proposed line 205?

l. 278-280 : here, the authors affirmed that the land degradation reduced the soil capacity for Corg stabilization. If the authors well used the model fitted by Hassink and Whitmore in 1997 ('As proposed by Hassink and Whitmore (1997), theoretical values of carbon saturation were established from the soil particle analysis' l. 158-159), they know that basically the model is in the form : $X = a * \text{clay content} + b$ with X the soil capacity for Corg stabilization, a and b some constants. As the soils in the reference and in the olive orchard have different clay content, they have different capacity for Corg stabilization! Here, it is like the authors were affirming that the land degradation has changed soil texture... I need more explanation and proof, please.

Technical corrections

Figure 1: Please, could you add bar scales or precise the olive orchard size in the part §2.1?

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