

## ***Interactive comment on “Soil carbon dynamics during secondary succession in a semi-arid Mediterranean environment” by A. Novara et al.***

**Anonymous Referee #2**

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This study examines soil carbon dynamics of bulk soil and its 3 soil fractions along the time since the abandonment of vineyards. The authors found increase in soil organic carbon in the upper 30 cm soil depth during the succession process from cultivated vineyards to woodland. This is an important topic for understanding how climate or land-use changes may affect soil carbon storage and fluxes. Moreover, understanding on this important issue is not consistent. Therefore, this study potentially can provide useful information to this issue. The topic of this manuscript clearly is appropriate for Biogeosciences.

However, the manuscript has numerous problems on both the interpretations/discussions and the organizations.

The Introduction and Discussion sections are relatively weak and should be further  
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strengthened. The logic is not clear at some part (see the specific comments) and the explanation is lacking. The Introduction and Discussion needs to be more focused on the first and second objectives and on the findings of this study, while the authors mainly talked about previous studies. Further, the mechanism of the variations of soil carbon stocks and their components during the succession is more interesting and meaningful.

The third objective is not discussed deeply in either the Introduction or the Discussion sections. In addition, the connection between this objective and the other two objectives is lacking and I would suggest deleting this objective.

Specific comments Abstract:

Page 1, Line 16: Should the R2 values represented here (0.83 and 0.88) be consistent with the ones showed in Figure 3 (0.79 and 0.73), and in which soil depth?

Page 1, Line 18-19: This sentence is confusing. Please rewrite it.

Introduction:

The authors emphasized too much on what have already been done and talked little about what is unknown and the contributions of the study.

Page 2, Lines 11-12: Too many references cited. Keep the most important ones (e.g. 3-4 refs), and do the same for other sections throughout the texts (e.g. page 4, Line 25 to page 5, Line 1-2).

Page 3, Line 3-16: Suggest using a summary sentence as the open sentence of the paragraph. Current first sentence seems irrelevant to the rest of the paragraph.

Page 3, Line 17-21: The cause-consequence logic of this paragraph is confusing. Explain why estimating carbon age would allow us to determine the abandonment age? And why this is related to the contents of last paragraph?

Page 4, Line 3-20: too much information. Suggest deleting details.

Page 5, Line 13-21: suggest combining the two paragraphs together and deleting the 3rd objective.

Materials and Methods:

How far away was one terrace from others? When were the soil cores sampled? How the soil cores were arranged spatially? What was the distance between the soil samples?

Page 7, Line 7-9: Data on environmental factors of the 7 sampling sites are needed to support this statement of homogeneous condition.

Page 7, Line 21-22: Keep the unit of soil carbon stock in the same format between Mg/ha and Mg ha<sup>-1</sup>, even t ha<sup>-1</sup> in Fig. 9. And do the same throughout the text.

Page 9, Line 8-9: Revise the 2 equations. “× 100%” should be added at the end of Eq. 3 and 4.

Page 9, Line 12-13: Add “‰” after the δ<sup>13</sup>C values (e.g. -11.3 ± 0.15‰. Also, the δ<sup>13</sup>C values here (-27.5 ± 1.91‰ is not consistent with its showed in Table 1 (27.5 ± 2.1‰.

Results:

Why were SOC in the 3 soil fractions shown in Table 2, 3 and 4 not stated in the Results section?

Page 11, Line 3: See comments on Page 1, Line 16.

Page 11, Line 7: Change “28 kg<sup>-1</sup>” to “28 g kg<sup>-1</sup>”.

Page 11, Line 8-9: Nitrogen content shown here is actually nitrogen concentration (% in Fig. 4), which is not consistent with SOC content (g kg<sup>-1</sup>) in the former sentences. Also, results of statistical analyses on the response of N content to abandonment age and soil depth is suggested to be presented in Table.

Page 11, Line 16: Excessive precision in the R<sup>2</sup> values is not necessary. Change “R<sup>2</sup>

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= 0.8175” to “R<sup>2</sup> = 0.82”.

Page 12, Line 17-18: Same doubt as Page 1, Line 16. R<sup>2</sup> = 0.94 and 0.91 as shown in Fig. 8.

Page 13, Line 4-10: This paragraph should be moved into the “3.4 SOC derived from the new crop in bulk density and in fractions” section.

Page 13, Line 15: According to the MRT values in Table 5, I don't agree with their argument that MRT values tended to be highest in the smallest fraction.

Discussion

Same as the Introduction section, the authors talked too much on previous findings and failed to explain more on the observations in this study. Although the authors claim the this study would improve our understanding of global carbon cycle, the review can't see this point after reading the discussion section.

Page 14, Line 1-4: More discussions are needed to explain the differences in SOC stock and its distribution between soil types (volcanic soil and vertisols) or climate conditions (semiarid and high rainfall).

Page 14, Line 5-9: Discussions on why nitrification and leaching were decreased since abandonment would be more appropriate to explain the observed phenomenon.

Page 15, Line 15-23: More references are needed to support this argument. Also see the general comments.

Not sure of the conclusions section is needed for this journal.

Tables and Figures

There are too many tables and figures, and some of them should be pooled together. I would suggest combining Fig. 1 and 2 to one figure, and Fig. 3 and 4 to one figure, and Fig. 6 and 7 to one figure. Only two decimals are needed for R<sup>2</sup>. Also, units in

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X and/or Y axes should be added, revised or uniformed in Fig. 3-10. Notes must be added to relate bulk soil and the 3 soil fractions to the specific chart in Fig. 8-10. In addition, SOC and  $\delta^{13}\text{C}$  in the 3 soil fractions in Table 3 and 4 could be shown in line figure, like Fig. 5.

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