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Interactive comment on "Ecological soil quality affected by land use and management on semi-arid Crete" *by* J. P. van Leeuwen et al.

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Dear reviewer,

Thank you very much for providing valuable and helpful comments on our manuscript. We have used your comments to revise and improve our manuscript in several aspects. Below we describe how we addressed your comments in the revised version of the manuscript.

A main comment, appearing in all three reviews regarded the many differences among the sites, and the lack of true replication that hamper specific conclusions about specific site-characteristics, especially land management. In our original manuscript we already have recognized this limitation of our study, but based on the comments by the

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Interactive Discussion

Discussion Paper

reviewers we now more accurately addressed this limitation in terms of the research aims, and hence the title of our manuscript. We followed a suggestion made by one of the other reviewers and changed the title into: “Biological soil properties under different land management types on semi-arid Crete”, implying that we treat ‘land management’ just like other differences among the sites. In the new manuscript we have consistently revised the text accordingly.

Most other comments were also highly appreciated and could satisfactorily be addressed in the new manuscript.

Below we will react on all points and describe how we have addressed them in the new manuscript. We have printed your comments point-by-point together with our response.

Comment-1: The manuscript “Ecological soil quality affected by land use and management” analyzed the effect of physical, chemical and biological parameters in soils in different land uses. The experimental design does not permit to understand at which parameters can be correlated the found values. The results are not innovative because they confirm the use of some parameters as indicator for ecological soil quality, that are largely used. The main difference with previous studies is the ratio of fungal to bacterial biomass, which is frequently proposed as indicator for C sequestration and disturbance. But in this case, due to experimental design is not possible give a clear statement on this indicator (the results could be affected by many parameters not considered in the experimental design, and therefore this difference does not exist).

Response-1:The remark regarding design, and the consequences for understanding the relationship between site characteristics, such as land use, and soil properties is addressed - see the general remark above. We agree with the reviewer that the study is not innovative in terms of the we measured and interpreted soil parameters, but as far as we know soil biological parameters have not yet been used to characterize soils in semi-arid regions. In such regions, we assumed that soil organisms face a relatively harsh environment, with consequences for their presence, abundance, functioning and

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indicator-value. We agree that we were not able to point out why the fungal to bacterial biomass ratio does not show significant differences under different land management types due to the confounding factors of climate and soil type. This is indicated in the concluding paragraph on page 202, lines 2-6.

Comment-2:The first part of introduction is too general; in the introduction miss the state of art regarding studies on ecological soil quality and land use/land management

Response-2: We have readdressed the introduction more towards the aim of investigating soil biological properties in semi-arid conditions, highlighting the novelty of this paper, i.e. the indicative value of commonly used soil biological parameters but under semi-arid conditions. In such regions, we assumed that soil organisms face a relatively harsh environment, with consequences for their presence, abundance, functioning and indicator-value (page 190, lines 20-24).

Comment-3: In mat and met there are some sentence that are repeated in the introduction: i.e. “Crete represents Mediterranean soils under imminent threat of desertification” and “The aim of the present study is to investigate soil quality at the Koiliaris CZO sites in Crete (Greece) that are considered to be at risk of potential soil degradation and desertification.”

Response-3: We removed this duplication in the text. The sentence (page 191 lines 11-14) is moved to the introduction. The specific paragraph in introduction (page 189 lines 23-28 and page 190 lines 1-5) is now describing the general characteristics of land management types, while the M&M holds the information for the specific sampling sites.

Comment-4: I suggest to add a map with the distance between sites. The main problem is the distance between the sites. Why do you have not use the same land uses in each site?

Response-4: Such a map can indeed be helpful and informative. In Moraetis et al

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(2014), the sampling sites are described including such a map. We refer to this map (page 192, line 9). Regarding the same land management types in each site, unfortunately the land management types were not all available at the same location.

Comment-5: Page 191 line 120-123, delete this sentence. It is not mat and met.

Response-5: We agree. The sentence is moved to the introduction.

Comment-6: Line 2 and 4 page 192 . How was litter removed ? Leaves? Or Prune residues? Which is the density of trees?

Response-6: The litter was removed by taking away the prune residues. The trees were planted in a density of about 100 trees ha-1. We added this information in the site description (page 192 line 1).

Comment-7: Chapter 2.2, not clear the sampling depth.

Response-7: Soil sampling depth was 0-10 cm. We specified this on page 192, line 16-17.

Comment-8: Chapter 3.1, delete : “To quantify soil structure, we measured the water stability of soil aggregates (WSA).”

Response-8: We agree: Sentence is removed.

Comment-9: Chapter 3.1 . To better understanding the difference of TN , could be important to have some information about fertilization. (Add it in M and M)

Response-9: We agree, information on fertilization is important to understand the soil properties. Unfortunately, it turned out to be a mistake in the original manuscript, the intensively cultivated olive orchard was not fertilized. Because fertilization was not mentioned as driving factor of soil biological properties, this change did not affect the discussion of the results.

Comment-10: The figure 1 is a repetition of the table 2 . Delete the figure 1

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Response-10: We agree: Figure 1 is removed.

Comment-11: How do you transform TOC in kg ha-1? Have you measured Bulk density? Add this information and the values of bulk density for all sites in the table 2

Response-11: We agree: Bulk density was indeed measured, and has now been added to table 2.

Comment-12: Delete in the discussion the following sentences: The aim of the present study was to investigate ecological soil quality in southern European soils that are at risk of potential soil degradation and desertification. In addition, we identified whether the currently used ecological soil quality parameters are adequate to assess soil quality under harsh conditions.

Response-12: We had these sentences in the discussion as short summary of the main objectives of the study. We have no problems in leaving them out, thus we did as the reviewer suggested.

Comment-13: After the first time, use always WSA for water stability of soil aggregates

Response-13: We agree: Water stability and aggregate stability are referred to as WSA throughout the text.

Comment-14: Discussion should be improved: (i)Consider the rainfall to discuss SOM parameters; (ii)The difference of SOC can be attributed to rainfall/land management ; (iii) Relation between SOC/ TOC and C/N inputs. (iv) different litter composition
Response-14: We extended the second paragraph in paragraph 4.1 by discussing the carbon content and the factors playing a role here, including the role of elevation and rainfall. The role of different litter composition is now discussed in lines 10-17 on page 198.

Comment-15: Chapter 4 Delete this sentence : The aim of the present study was to investigate ecological soil quality" It regards objective (introduction)

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Response-15: This sentence is clarifying the aim of the study, and hence is linked to the limitations of this study, which is why it is repeated in the discussion, lines 4-6 on page 201. Although we agree that the sentence is repeating the aim stated in the introduction, it enhances the reading and understanding of the paragraph in the discussion, which is why we left the sentence in.

Comment-17: Again table 3 and figure 3 contain the same values.

Response-17: We included the values in both table 3 for completeness, and in figure 3 for enhancing the visualization of the main results from the study. We have however no problems in leaving figure 3 out, such we did as the reviewer suggested.

Interactive comment on SOIL Discuss., 2, 187, 2015.