

# ***Interactive comment on “Agropedogenesis: Humankind as the 6<sup>th</sup> soil-forming factor and attractors of agrogenic soil degradation” by Yakov Kuzyakov and Kazem Zamanian***

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The authors introduce a theory of anthropedogenesis – soil development under the main factor ‘humankind’ – the 6th factor of soil formation, and deepen it to encompass agropedogenesis as the most important direction of anthropedogenesis. The theory of agropedogenesis is a very important issue in pedology and there is a clear gap in knowledge related to this issue and the outcomes of this research certainly help to better understand the dynamics of soil development under agricultural practices.

- We are very thankful for this positive evaluation and suggested improvements. Please see our improvements and answers below.

Although the contents of the manuscript is fairly good, it would benefit from better editing (e.g. grammar and clarity), which would improve its clarity.

BGD

- We sent the ms once again for the improvement of the English language.

In addition, some necessary improvements are suggested in the following:

1) More comprehensive literature review on soils [e.g. semi-arid tropical soils] showing no sign of soil degradation by growing agricultural crops in soils.

- This point is based on the comments given by Dr. Pal about the necessity to exclude semi-arid tropical soils from the concept of agropedogenesis. The point that Dr. Pal emphasized to be “no-sign-of-degradation” is solely based on stability of SOC content over 25 years of cultivation in semi-arid tropical soils of India. This is however, because of yearly addition of large amount of organic fertilizers which keeps the SOC content at a high level along with the presence of alkaline soils which prohibit soil acidification. This, in our opinion, is temporary condition (i.e. pedogenic inertia) and following decalcification of topsoil (when attractor of  $\text{CaCO}_3$  is achieved) the mentioned soils will also face acidification and so, degradation and crop reduction. We already addressed in the text that such conditions may also take place (see lines 210-211) due to soil intrinsic master properties which are far from their threshold values to cause soil degradation.

2) It is also important to discuss more thoroughly, why these soil properties were selected [Master soil properties]. In particular, a reader would like to know whether these soil properties are intrinsically more important than the others or simply more important in this study due to some identified characteristics and assumptions.

- The main characteristic of a soil property to be a master property in agropedogenesis concept is its sensitivity to agricultural use. Further, changes in the values of the so-called master properties should determine the state many other properties over cultivation period. See section 2.4 as we defined the master properties and their particular characteristics. Also the most other studies suggested these properties (see Table 3).

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We would like to discuss these soil properties and the reasons in the next paper. This paper is already too long for individual description of each of the nine properties.

BGD

3) It is necessary to explain clearly the figures in the main body of the manuscript.

- We agree. The Reviewer #1 mentioned the same. In the improved version we presented more explanations and details to the figure legend.

Some other comments are made along with the text: Keywords: I think five keywords are enough.

- We developed a theory which is not only connected to the effects of human on soil conditions but also to the effects of human in general on planet Earth and so, to the Anthropocene. This includes many aspects which we tried to address by the key-words for a better indexing by the searching programs. We deleted 4 Keywords (but added 2).

Line 4-5: This first sentence of the abstract should be removed.

- This sentence actually shows the relevance and significance of studying the effects of human on agricultural soils. It shows that human through agricultural practices may affect a huge land surface area. Deleting this sentence will raise the question of how significant or relevant is this study. If the Reviewer insists on it, we will delete this sentence.

Line48-49: Please clarify this sentence "Since the suitable land resources for agriculture are limited and increasingly located in ecologically marginal conditions".

- The suitable land areas for agricultural practices are limited. Therefore, many studies are focusing on protecting strategies to save such areas against degradation causing decreasing food production. Furthermore, if intensification in crop production on the available land is not considered then, we have to cultivate the ecologically susceptible areas for example shallow soils on steep slopes. We simplified the sentence.

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Line 50: add cit.

- Lal et al., 2005 has been added.

Line 73: run-off irrigation and terracing

- "and" has been added.

Line 80: add cit.

- FAO 2018 has been added.

Line 87: "The human factor can even change soil types as defined by classification systems (Supplementary Fig. 1)".

- The sentence is correct similar to what the reviewer has written.

Figure 1 indicates the convergence and divergence of soil properties!

- Under natural soil genesis, yes (the green lines) but convergence under agropedogenesis (red lines). The fig. is however, improved for better clarifications.

Line104: add cit.

- See Dudal, 2004 (line 101).

Table 2: justify Table 2

- We wanted to bold the main soil formation processes under agricultural practices and their consequences on soil properties. Could you please let us know what you mean with justifying the table?

Line 122: climate, organisms, relief and time

- It has been revised accordingly.

Line 139: climate, organisms, and relief

- It has been revised accordingly.

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Line 140: "...over time. Thus, morphological soil properties...". This sentence should be rewritten.

BGD

- The sentence is re-written as: Therefore, visible morphological soil properties in the field and measurable parameters in the lab were very well described leading to development of various (semi)genetic soil classifications

Line 143: Figure 2.

- Corrected

Line 153: add cit.

- This is authors definition of soil degradation and its stages.

Line 180: climate, organisms, and relief

- It has been revised accordingly.

Line 201: How is possible to infer the decreasing in the spatial variability of soil properties in figure 5.

- The sentence has been corrected. Fig. is now in supplementary materials

Line 847: "(c) and(d) total soil carbon"!

- The sentence has been corrected.

Lines 273-lines 299: the definition of phase diagrams would be necessary. Not sure that every Biogeosciences reader is familiar with them.

- We added the definition of the phase diagrams (see line 277).

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