Review of: "The impact of land use practice on the spatial variability of soil physicochemical Properties at Wondo Genet, Southern Ethiopia"

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Potential competing interests: No potential competing interests to declare.

The study describes the impact of land use change on various soil properties at two depths (0-30 and 30-60). The study makes use of a space-for-time approach where some sites are natural forest and other sites have been converted from natural forest to plantation forest or agricultural land. The study provides very interesting data on a relevant topic. The manuscript is structured in a way that is easy to follow. However, there are some errors in the translation of results from tables into text. In addition, it was not clear to me what was done from the methods section.

A general comment on Section 3.3:

Since the methods section is not very detailed, I am left with some questions. How did you assign land-use classes to the data points from the HUSD database? Was this part of the database or did you relocate the datapoints on the current land use map? And if the latter, can you be sure that the current land use is the same as the land use at the time of sampling and that the forest was not converted later? Do you have knowledge of the time of conversion of the sites? And if so, could you mention that information in the methods section.

Please find my specific comments below:

Abstract:

Please, write NF and PF in full.

Scientific species names, Cupressus, should be italic. This also for the rest of the paper.

Figure 1:

Would it be possible to indicate the different land-use types in some way, for example by using different colours for the circles indicating the soil sampling locations or mapping the different land uses?

Section 2.1:

In the rest of the manuscript, you often imply that the natural forest is more diverse than the plantation forest, which is fair. But as far as I remember, you never state this explicitly. Maybe you could provide some information on this here.

Do you have an idea of when these sites were converted to agricultural land and plantation forests?

Section 2.2:

it is not clear to me how many samples were taken in the agricultural and plantation land-use types. Was only one sample taken from each vegetation cover? Were these also composite samples as was the case in the natural forest?

You write “The forest has been separated…”. Could you add “natural” to “the forest” to make a clear distinction between the plantation forest and the natural forest?

Section 2.3:

Do reference 46 and 47 provide the procedures to analyse the soil properties you measured? Would it be possible to give a little more detail on the analyses, e.g. what pH have you measured?

The unit for microbial biomass is incorrect, I think. Should it be ug / g dry soil? Please, provide this unit to microbial biomass N as well.

Formulas: I don’t know what these formulas mean. What is NF, F, B, Fu, and NFu? Could you give a brief explanation with the formulas?

Soil Aggregates: It is a bit strange to start with the title “Soil Aggregates”, when you have not done this for the other soil properties. You could just omit those two words from the sentence.

Section 2.3.1:

Please, add a reference to the HUSD database.

“using ordinary kriging methods several raster layers for different soil parameters were generated using the…” What soil properties? The properties you measured or the properties you obtained from the HUSD database. It is unclear to me what data you have used from the HUSD database. Could you specify “measured soil properties” or specify the specific soil properties that you are talking about here, please?

Section 3.1:

“(farmland, plantation, and natural forest)” In another section (2.2) you refer to them as “(Natural forest, Plantation forest, Agricultural land)”. Another time you use “cash crops”. This is maybe a bit nit-picky, but could you be more consistent in the way you refer to the land uses? That way it will be easier for the reader to follow.

“Soil physicochemical characteristics and microbial biomass vary significantly…” All the physicochemical characteristics? Could you specify what characteristics? Why do you speak here of microbial biomass in a section about soil physical and chemical properties?

Paragraph 2: Sentences 1 and 2 seem to say contradictory statements: “no significant differences between land uses” and “Cash crops have a greater bulk density”. Could you elaborate on this?

Paragraph 3: “somewhat acidic” is this significant? Could you specify what you mean by somewhat acidic?

Figure 2:

Why are the pH results in a figure and the other results in a table? They could be presented in a consistent way, since they are similarly structured.

Personally, I think figures say more than tables (although tables have their uses as well of course). And I think you could make this figure even more informative by giving each depth another colour. Now the two depths kind of blend into each other and it is hard to match up the point with the depth x land use.

Could you also add some significance letters to this figures as you did in the tables.

Paragraph 4:

Could you specify at the start of the paragraph about what depth you are speaking?

Table 1 and 2 should be switched, since you first refer to table 2 in the text and then to table 1.

“in the eucalyptus plantation and natural forest, respectively, meso and micro-aggregates…” I find this sentence a bit confusing. I think the “respectively” should come later in the sentence, but maybe it is better to just split this sentence up? You say they are “greater”. Greater than what?

Some of the percentages in this section are incorrect: 6.6 is in the wrong place in the sentence. 36.39 is mentioned twice and both times incorrect according to table 1. 53 and 33 are rounded down, when they should be rounded up.

“This was lower than Cupressus…” what do you mean by “this”? Together macro, meso, and micro aggregates are a 100%, if I am correct? So, should it not be the same for all land uses?

“Natural forests, on the other hand…” I don’t follow the reasoning in this sentence. How I read this sentence, you are saying that the soil disturbance is cause by the SOM distribution. Could you rephrase this sentence, please?

“lower aggregetes” Smaller aggregates? Why is there more soil disturbance in a natural forest than in plantation forest or agricultural land? Could you explain?

Paragraph 6:

Could you write the names of the crops in full, please? Also in the rest of the manuscript. Or use the abbreviations consistently. Do not switch between abbreviations and full land use names.

Paragraph 7: I am not so familiar with the agricultural practices in this region, but could you not expect more N in agricultural soil due to fertilization? Could you elaborate on this?

Section 3.2

Paragraph 1: 11.3 to 81 is incorrect according to table 3. I think this is the range for MBN.

MBN in the text (16.37 etc): I cannot find these back in the table. Please, check the numbers you have mentioned in the text with the numbers in the table for the whole manuscript, since there are quite a few errors.

“It was observed that…” and “The MBN content…” say exactly the same. Omit one of the two sentences, please.

“The order of the level of MBN…” is this consistent for both layers? Could you specify?

Paragraph 3: Could you specify about what land uses you are talking here. Where do you expect high levels of root debris? This section is giving a reason for high microbial activity, but in what land use?

Table 3: You forgot the “<” in “P 0.05”

Section 3.3:

Paragraph 1: line 1: space between “the” and “soil”.

Aha, that is what you used from the HUSD database. Please, explain this better in the M&M! Also, mention the abbreviations of the soil properties in full, the first time you mention them.

Why did you do the land use types and the depths separately and not together as in the previous sections? It would be interesting to see what the difference in soil depth is for each of the land use classes.

What do you mean by “the soil is acidic in the three-dimensional space”?

Paragraph 2: Please rephrase the second sentence.

Figure 3: Can you specify what depth this is, please? Idem for the following figures.

Paragraph 3: “no major differences” Please, consider rephrasing to make clear that these are not significant.

“no considerable variation” should be “no considerable variation between land use types”, you did find significant variation in depth! And in Figure 4 you can see that there is horizontal spatial variation, just not linked to land use. Could you elaborate on that? Is the variation in P in this region linked to other factors, like geology? P is less mobile, so maybe less likely to be linked to land use change?

You have not mentioned Figure 4b. Could you also mention what we see here, and maybe try to explain?

Paragraph 4: What is “natural carbon”? “…6.31 to 8.34 g/kg while…” You are using both values for depth and land use in this range, which does not really make sense, since the depths are averaged over land uses and the land uses are averaged over depths. Please rephrase this sentence and use the OC range for land uses OR the OC range for depths.

The natural forest does not have a maximum value of 8.34 according to table 4. Please, correct.

“(p 0005)” should be “($P < 0.05$).

"…the spatial variation and distribution of soil organic carbon and CEC…" "lower" than what? Please, specify. Also, variation between depths is also a form of spatial variation, and you have found significant differences for SOC between depths. So, consider rephrasing.

The CEC range you mention in the text does not match the one from the table.

Paragraph 5: you start a new paragraph, so I assume you are now talking about a new property, but you do not specify the property in the first sentence. Could you please mention what you are talking about?

Section 3.4.

I have no experience in these geostatistical models, so I cannot comment much on them. However, I think it would be interesting if you would elaborate more on the ecological interpretation of these results.

Conclusion:

"this means that soil characteristics are more susceptible…" more susceptible than what? Please, specify.

You speak of rhizobia, but this is nowhere mentioned in the manuscript. What are you referring to? Could you use another word that you already used in the manuscript?