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Biogeosciences Discussions

Interactive comment on "Changes in Particulate and Mineral Associated Organic Carbon with Land Use in Contrasting Soils" *by* Sabina Yeasmin et al.

Anonymous Referee #2

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The paper addresses the impact of land use change on OM pools in soils with different mineralogy, both at surface and sub-surface depths, which is a relevant topic for publication in BG. Bulk soils were separated into four density fractions, which were then analyzed for their mineralogy, OC and N, isotopic signature and 14C.

My biggest concern about this manuscript is the study design. Only 1 plot per soil type and land use was included in the study, and thus only 1 field replicate was analyzed, given that subsamples collected within each plot were pooled. Therefore, no statistical comparison between adjacent plots is possible and no conclusion regarding the effects of land use change on SOM pools can be drawn. In fact, the different trends in SOM pools after LUC among soil types cannot be ascribed only to the differences in mineralogy, but other important aspects can influence the results, e.g. cropping and tillage

practices, OM inputs, climatic conditions, etc., which the manuscript does not take into consideration or does it only marginally.

Additionally, the manuscript is weak in the following key aspect: - Fundamental details of the sampling strategy (n. of samples per plot, sampling methodology, distance between sampling points) and site design (plot size, and distance between paired plots) are missing;

- Lack of information regarding land use and management at the different sites, which are essential for the result interpretation (e.g. former and current crop species, tillage practices and depth at the cropped sites, OM input at each site e.g. fertilization, crop residue input. . .);

- The main research question are not presented clearly both in the abstract and in the main article;

- Results and Discussion sections are not well structured and often difficult to follow due to a lengthy presentation; Discussion section is too speculative, mostly based on results found by former studies and only partly supported by the obtained results.

SPECIFIC COMMENTS:

ABSTRACT

Is there a "diverse OM input" in soils having different mineralogy (see line 27)? OM input quantity and quantity play a relevant role in determining changes in SOM pools after LUC, and differences found at the different sites cannot be attributed only to mineralogy. Other several variables could have contributed to the observed trends (OM inputs, land use and cropping practices, climatic factors. . .), which the paper is not properly addressing.

It is not explained why a shift in the isotopic signatures could have occurred (e.g. shift from C3 to C4 plants?), at line 30-32.

INTRODUCTION

At Line 49 to 51, it is stated that LUC generally lead to a decline in SOC, but this is not correct, see Guo and Gifford, 2002.

In the paragraph on soil density fractionation, POM is defined as “labile” fraction, without further explanation. This is not always the case, check also Von Lützow et al., 2007. Also at line 75, it should be clarified that organo-mineral associations better protect OM from decomposition but the OM is more processed than the POM fraction (check also Lavallee et al., 2019).

The paragraph at line 86-93 is too descriptive and should be better linked with the research questions. Which kind of insights about of SOM pools do you want to obtain, and why?

Additionally, research questions should be presented more clearly and concisely. It should also be clarified why 2 specific soil depth were chosen for analysis (0-10, and 60-70 cm), in relation to the rooting system and tillage depth, and why a certain Australian region was chosen as a study area (is the specific LUC relevant in that region?).

MATERIALS AND METHODS

In the site description, a precise description of the paired sites is missing (plot size, distance between adjacent sites, precise time of LUC in each site, tillage and cropping practices as tillage depth, fertilization etc; crop and tree species/main understorey vegetation.)

Moreover, fundamental details of the soil sampling strategy (n. of samples per plot, sampling methodology, distance between sampling points) are missing. Also, are organic layers present in the native woodland? Have these layers been sampled? At line 122, what does “absolute mineral soil” mean?

Regarding soil fractionation, how the different densities were selected, e.g. 1.8 g cm-3 to separate POM and MOM?

RESULTS

Presentation of results in paragraph 3.1 “general soil characteristics” and 3.2 “mineralogy of density fractions” is lengthy and not linked to research questions. These paragraphs are focused on site characteristics and differences in mineralogy among sites, but not on the effects of LUC, which seemed to be the main research question in the introductory part.

Regarding the obtained results, nothing can be said statistically about observed trends. The phrasing used in the text (e.g. “remarkable”, “notable”..) should not be confused with statistical comparison.

Absolute values of C stored in the different fractions and bulk soils are missing, while only proportions and C concentrations are shown. These data would help explaining the OC losses in the mineral soil.

DISCUSSION

Paragraph 4.1 is mainly about the presentation of C/N ratio trends, so the title “general trends of organic carbon. . .” is not appropriate. Again, in paragraph 4.2 (404-440) a large share of the discussion is about the role of minerals, while the title reports: “effects of vegetation type”.

All the discussion section is rather speculative (see line 460-469, 480-490), and most of the discussion misses a clear support from obtained data.

CONCLUSIONS

Conclusions about effects of LUC and mineralogy on OC are not supported by data: no statistical comparison is possible, and no information regarding cropping practices, and generally about land use management are provided, which can have a great influence on the observed results.

C storage in sub-surface layers is mentioned in the conclusion, but this aspect was not

investigated in the current manuscript.

FIGURES AND TABLES

Mention in the Fig. 1 caption the meaning of error bars.

In Fig. 1: I think that it would be useful to normalize the histograms to 100%, otherwise it is difficult to understand the POM and MOM trends.

Fig. 2: in the different graphs (a1 and a2, b1 and b2, c1 and c2) different scales are used, which is confusing.

Fig. 3: you should add also p values of the observed relationship.

Table 3: add the nomenclature oxide, phyllosilicates and quartz presented in the text at line 267 for a better understanding of the table.

TECHNICAL CORRECTIONS

Line 57: “with differing” is incorrect, change to “differing”

Soil types are sometimes presented in a different order in text and figures (e.g. line 271, 292)

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