

Interactive comment on “Soil organic carbon stocks in semi-arid West African drylands: implications for climate change adaptation and mitigation” by Jérôme Ebagnerin Tondoh et al.

Anonymous Referee #2

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General This paper throws up many questions and issues pertinent to Sub-Saharan Africa which are then not properly discussed. E.g. modality of rainfall and how this might affect SOC, mixed smallholder farming, appropriate management options for given socio-economic conditions, the cumulative sequestration potential of large areas of drylands with low per ha potential. Instead the discussion seems in places to be very general, making general comparisons with other parts of the world which seems odd. My feeling is a lot of really useful data and information have been collected in this study but the discussion needs to be strengthened. If the authors can say more about the specific cropping systems and management practices at the sites how these impact SOC and then link this to recommended land management practices the paper

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would be enhanced. If this done carefully, and more regional issues are discussed, then the paper will be very good.

Abstract You should mention the sampling depth here to put the SOC storage estimate that you present into context.

Introduction line 60 and the paragraph below. You need to clarify what you mean by ‘traditional agricultural practices’ or reword this. If you are talking about ‘traditional practices’ which allow the land periods of rest e.g. nomadic or rotational systems then your argument doesn’t stand, however if you are referring to agricultural practices adopted in the recent past which are repeated on an area of land and are overly extractive then you need to say so here. I am not an expert on West African systems and as such would like to see more clarification here. Line 67 be careful how you use the terms SOC and SOM. Here you say SOC provides nutrients when what you actually mean is that SOM provides nutrients. Line 70 – 72 This statement is misleading. If you have a soil with depleted SOC to a certain point its capacity to be a sink for C will be increased, however if it goes below a critical threshold its capacity to be a sink will be diminished. The relationship is complex. Either reword or omit the first part of this sentence. Line 87 It is good that you talk about making ‘site specific’ recommendations, recognising the importance of context specific interventions.

Materials and Methods 2.1 Study area. In addition to talking about total annual rainfall it would be good if you could say something about rainfall distribution in these areas. Is it modal, bimodal? This can be important when considering the impact of land management interventions on SOC stocks. Line 116 seems odd that you mention a fertiliser application rate (125 Kg ha⁻¹) and the fact that it is NPK without saying how much of the application is N (which is the most important thing to know). If possible I would include a typical rate of N application if you can (a typical rate for the region would suffice). Line 154 I think there is a word missing here ‘The acquired spectra were used to ?? SOC prediction models’ calibrate?? Line 76-77 why convert to CO₂ equivalents for a stock? You need to say more about the ‘semi natural’ land control

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sites. What is the land cover/use. How were they chosen. Were the agricultural sites you considered in this 'semi natural' state 20 years ago as well? Results Line 222. I would put in a reference here referring to other studies which have shown MIRS to be a good way of analysing SOC. E.g. . . .in agreement with ??? et al. Line 247 – 249 why do you omit the total SOC stock for Lambussie here? May as well include it. Line 252 to reiterate the point made earlier, the reader doesn't know enough about the 'semi natural sites' or the land use history of your study sites to fully understand what your results mean.

Discussion 4.1 Site characterisation After reading this section the main message I took away was that perhaps the landscapes you considered were too heterogeneous for the sampling strategy employed. I don't think this is the impression you want to give. However I think what your discussion needs is a frank discussion of this heterogeneity and an analysis of the uncertainties that result from this. Line 302 it is easier for the reader if you use consistent terms to describe the layers e.g. 0-20 cm and 20-50cm. I wasn't sure here which you were talking about. Also in this sentence be consistent with showing error, e.g. you say 11.2 ± 0.7 then you just say 22.4. Line 309-311 good point! Line 319 – 321 I would guess that erosion could be a greater determinant of SOC than acidity here? It would help if you gave the reader an idea of the steepness of slopes being cultivated, even if it is an estimate of the steepest seen. Line 325 after Tigray I would add 'who's study revealed' otherwise it sounds like you are claiming your study shows cropland stores less SOC than agroforestry. I would also try and use the term 'rainfed annual crop production' if this is what you mean although I appreciate that in many smallholdings annuals and perennials are mixed together. Line 347 – 349 I wonder how useful it is to compare your results to a generalised 'global' sequestration potential such as the one given by Lal? I think it would be much more useful to compare your results to an estimate of potential that applies to dryland areas with a similar rainfall modality. Lines 380 – 381 you discuss management options for increasing SOC. It would also be good if you said how plausible you think some of these are in the specific socio-economic conditions in the area you studied.

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Conclusions This section is very good!

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