

Interactive comment on “The influence of C₃ and C₄ vegetation on soil organic matter dynamics in contrasting semi-natural tropical ecosystems” by G. Saiz et al.

Anonymous Referee #3

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General comments:

The current paper addresses the topic of land use change (i.e. vegetation thickening) and its effects on soil biogeochemical cycling, an important topic considering current and future changes associated with global climate change. The study also discusses the effects of land use changes associated with woody encroachment on belowground C/OM dynamics, a key component, and yet largely overlooked, of the global C cycle. The authors make use of C isotopes ($\delta^{13}\text{C}$ and ^{14}C) to quantify the contribution of C₃ and C₄ vegetation on SOM dynamics in semi-natural (mixed vegetation type) ecosystems along a precipitation gradient in western Africa. The topics addressed are therefore well within the scope of Biogeosciences and would be of interest

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to the readers of this journal and the general soil science community. The manuscript is well written and logical throughout. The English is clear and of an acceptable standard (some minor changes are suggested in the technical corrections below).

Specific comments:

- (1) In the methodology section (p.8) the soil sampling strategy is described. Three soil samples were collected for the upper soil surface layer (0-0.05m) however just one sample was collected at 0-0.3m. Why? I assume this was mainly related to ensuring enough sample volume for the lab analyses? Please clarify why there is this discrepancy.
- (2) In the results section, the authors mention the discrepancy between –T and –G sampling locations at each site was consistently larger at the savanna sites compared with the forest sites – why? Can you provide an explanation for this observation?
- (3) In the discussion section (4.2 Differential patterns in SOM dynamics across contrasting C₃/C₄ mixed ecosystems) the authors mention the difficulties associated with quantifying belowground litter dynamics. Did you make an attempt to quantify rhizodeposition? Such data would very interesting to see.
- (4) Figure 2(b) shows the relationship between weighted $\delta^{13}\text{C}$ and fractional vegetation cover for the 0-0.05m surface soil layer. Were similar relationships found for the 0-0.3m soil layer? Why is this data not shown?
- (5) Figure 6, site BDA-03 has no data point for the deeper samples (i.e. 0.3-0.5 – 0-0.05m). Is this a mistake or are no data present?
- (6) The manuscript has a total of 94 references. This is a very large number of references! Perhaps the authors could be a little more selective in some sections.

Technical corrections:

p. 2 line 42: with this trend also being

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p2. line 45: to minimise the confounding

p2. line 47-8: even in deep soil layers, while the most stable SOM fraction associated with silt and clay

p2. line 49: These results, together with. . .

p2. line 54: 'are at variance' – what does this mean? Please clarify/change text.

p3. line 79-80: useful tool for investigating the influence. . .

p4. line 81: and for identifying recent. . .

p4. line 85: utilize

p4. line 91: those associated with

p5. line 120: it remains a challenge to assess

p5. line 124: ecosystem processes and studying the potential impacts

p5. line 129: this expansive region

p6. line 137: can help assess

p6. line 140-3: of this study are: (1) delineate the spatial. . .(2) investigate any potential. . .(3) unambiguously evaluate. . .

p7. line 149-150: present work have been provided in detail

p7. line 152: Hence, a short summary is provided here

p7. line 155: Ghana, Burkina Faso, and Mali

p7. line 160: the latter also being the case for

p7. line 162: The transect was established on consistently flat terrain

p7. line 165: nutrient poor Arenosols on the Southern border

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p8. line 175: that has been proven to be well suited

p8. line 183: 40mm inner diameter (iAę). All samples were placed in labelled zip-lock bags.

p9. line 203-4: any traces of salt, dried at 40oC, and the weight of each fraction was determined. . .

p10. line 231: depth intervals to help explain potential variations

p11. line 255: the southern end of the transect

p11. line 260: lower C/N values were associated with

p13. line 292: a Sahelian site showed a gradual decrease

p13. line 297: increase in SOM $\delta^{13}C$ values with soil depth

p15. Line 326-7: reflects current vegetation patterns well

p16. line 343: major effect on both the physical protection

p16. line 359: Indeed, there was considerable

p17. line 364-5: by some earlier studies, suggests that such variation

p17. line 372: C/N ratios, a feature considered to be highly relevant

p17. line 383-4: soil fraction that best reflects recent organic inputs to the soil, as it includes contributions

p18. line 410: much lower abundance of C4 vegetation which seems is progressively

p18. line 413: consequently an overall negative

p19. line 430: litter carbon chemistry is a key factor

p19. line 437: extrapolated given that these

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p20. line 448: between the surface (0-0.05m)
p20. line 452: at the wetter sites along the transect
p20. line 454: main determinants of vegetation type observed at each site
p20. line 460: agrees well with the long-term persistence
p22. line 491: fractions associated with silt and clay
p22. line 505: combined effect of several factors, including OM decomposition
p22. line 508: influenced by specific properties
p23. line 521: These sites are characterized by a low abundance
p23. line 528: root biomass with depth, this trend is more obvious
p24. line 554: between the two sites is strongly influenced
p27. line 582: The reference $^{14}\text{CO}_2$
p27. line 584: Simple interpolation was used to quantify the $\delta^{14}\text{C}$

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