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 (ïA ̨d'13C and 14C) to quantify the contribution of C3 and C4 vegetation on SOM dynamics in semi-natural tropical (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 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).

We thank the reviewer very much for his/her comments and provide answer to the specific comments below. Our comments are in bold font.

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.

In the section 2.2 Soil sampling, we now state that: 'Three replicate samples were collected at 0-0.05 m to smooth out local heterogeneity, which is generally more pronounced closer to the soil surface compared to deeper locations'.

(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?

This is because of the distinct carbon isotopic ($\delta^{13}C$) values of tropical grasses and woody vegetation. In savanna environments many grasses employ the C_4 photosynthetic pathway (-14‰) compared to the $\delta^{13}C$ value of trees and shrubs that utilizes the C_3 photosynthetic pathway (-27‰). As the presence of grasses in savannas is substantially larger compared to those that might be observed in forests, the differences in soil $\delta^{13}C$ values between –T and -G sampling locations will be more pronounced in an environment that contains both C_3 and C_4 vegetation than in one mostly dominated by C_3 vegetation.

(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.

We agree that this would have been quite an interesting variable to measure but to do this in a robust way was well beyond our reach.

(4) Figure 2(b) shows the relationship between weighted d13C and fractional vegetation cover for the o-0.05m surface soil layer. Were similar relationships found for the 0-0.3m soil layer? Why is this data not shown?

Indeed, similar relationships were also found for the 0-0.3 m interval, although the degrees of fitness were slightly lower compared to those observed for 0-0.05 m (0.72 for the relationship between the weighted average stable carbon isotopic composition and both the fractional vegetation cover (FC) of all woody vegetation taller than 1.5 m, and

0.92 for the relationship concerning the axylale vegetation (grass and herbs)). Obtaining lower regression fits when deeper soil intervals are considered is hardly surprising as the topmost layer (0-0.05 m) reflects better recent vegetation inputs and their $\delta^{13}C$ values are likely to be less affected by potentially contrasting SOM dynamics. Therefore, we decided to include the depth that better reflects standing (current) vegetation (0-0.05 m), and not add an extra graph for the 0.30 m interval.

(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?

BDA-03 is a grassland site growing on hardened plinthite crust occurring less than 0.2 m from the surface. This fact is now included in the figure caption.

(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.

We agree that the number of references is considerable. We have revisited all of them and feel that their inclusion helps the reading and understanding of the MS.

Technical corrections:
p. 2 line 42: with this trend also being
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
p8. line 175: that has been proven to be well suited
p8. line 183: 40mm inner diameter (ïA¸e¸). 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 ïA¸d’13C 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
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 14CO2
p27. line 584: Simple interpolation was used to quantify the ïA ţ'

The expression ‘at variance’ in that context means: not in accord, differing.
The technical corrections have been revised as suggested.