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Biogeosciences Discussions

Interactive comment on "Mean age of carbon in fine roots from temperate forests and grasslands with different management" *by* E. Solly et al.

Anonymous Referee #2

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Overall, the work provides an interesting contrast between the mean ages of C in grassland sites and forest sites. In particular, the finding that mean C age in fine roots was more variable in forests was interesting, and upon thinking about it is logical.

The authors do a good job explicitly stating they are not measuring and reporting root turnover (lines 92-94). This is an important distinction. However, because it is so important it would be good to restate that distinction or difference later in the paper again (discussion section perhaps) just to make sure that readers do not misinterpret the data.

Regarding statistics, the authors layout their plant for statistics in the methods section. However, when describing the results in the results and discussion sections it is sometimes unclear which results were tested in what way. For me, this caused confusion as

to why some results were described as significant in some places and not significant in others.

A final weakness, that unfortunately cannot be undone at this point, is the use of a simple size classification of <2 mm to define fine roots. There is now ample evidence to show that this distinction is not appropriate and should be avoided. All future studies should take note of this and work to utilize/develop more functional definitions of "fine roots" based on their likely roles for absorption, transport and/or storage. This limitation here does make it difficult to interpret some of the results. For example, the paper reports that the man C age in fine roots was more variable in forests than it was in grasslands. This may be true, but it may also be that forests and forest species produced more variable amounts of short-lived, absorptive roots vs. longer lived, transport/storage roots. Both of which can be easily found below 2 mm. Despite this weakness, I still feel that the manuscript is of sufficient quality, novelty, and importance for publication.

A more specific comment from Line 200: Does this approach assume that age of C in fine roots (average root age plus length of time C is stored in plant) is constant through time or at least since 1950? If is not constant through time, is it valid? It probably won't be constant through time due to interannual variability in climate leading to different storage capacities and fluxes and due to periodic disturbances quickly draining reserves.

Specific Comments: Throughout the paper, whenever there are multiple citations a space needs to be added between the semicolon and the next citation. Lines 28-29: Is the difference here due to soil texture or due to other variables (temp/altitude, precip)? Line 35: "fine plant roots" change to "plant fine roots" Line 35: add space between 2 mm Line 35: this class of all roots < 2 mm will include roots with different functions (i.e. short-lived absorptive roots as well as longer-lived transport roots). This is mentioned later in lines 49-50, so at least the problem is acknowledged.

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Lines 43-45: The sentence might read better if “derived from the root standing stock and belowground C fluxes” were moved to the end of the sentence.

Lines 76-77: Majdi doesn’t say cleanly that they ARE a useful method, more that they may or can be a useful method assuming great care is taken. This caveat should be expressed.

Lines 88-89: The wording "average time elapsed between C fixation and its incorporation into root tissues" is tricky but correct. If possible, it should be made clear that this is not the same as actual root turnover. This is cleared up in the next paragraph (lines 93-94) but it may be useful to allude to the potential problem here as well.

Line 117: should the word “managed” be added between age-class and forests?

Lines 124-127: A little more explanation/clarification here would be useful.

Line 132: change “selected always” to “always selected” Line 133: “20 m long in grasslands and 40 m long in forests”→ I assume the cores were evenly spaced across the transects in both systems (i.e. cores were further apart in the forests)? Please clarify. Line 135: mixing the material selected? Does this mean that not all sample was used? If all sample was used (within the 0-10cm increment) than it might be better to say ’collected’

Line 139: <2 mm. I still think this is a problem as this size classification will contain many roots of different function and very different turnover times.

Line 152; add space, 500 m2

Line 154: Insert comma after “grasslands”

Line 157-158: this is not clear. Can more details be added?

Lines 160-161: Can more details be added here?

Line 176: add space between 2 mm Lines 230-234: While statistical significance is

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given in tables, it would be helpful if the authors details what results were significant here in the text as well. Terms like “greater” “pattern was reversed” “greatest” “highest” “higher” “slightly higher” may all be useful but should be qualified/clarified as to what is significant or not. Lines 263-265: very interesting Line 265: In regards to the interpretations of the unit risk ratios reported, it is difficult to know if this has much meaning beyond this study. Qualitative descriptions of the risk ratios may more helpful/appropriate. Lines 266-267: This is based on the risk ratio information? Lines 269-274: These two sentences appear to contradict each other. Did diversity increase or decrease with soil N? Please clarify. Line 277: Should this be a “>” symbol instead of “<”? Line 282: it might be helpful to restate the hypothesis and/or rationale here. Lines 295-296: This sentence seems to be the start of a new paragraph. Lines 296-298: True, but this was across 1st to 5th order roots (distal roots being 1st order), all of which were < 2 mm in diameter and therefore all of which were included and lumped together in this study. Lines 366-268: I do not follow the logic here. Please explain.

369-370: Larger C inputs in more fertile sites? Table 5 shows no significant response with fertility and either standing root biomass or mean C age. Please explain.

Lines 376-378; Yes, this is a valid take-home message from their work.

Figure 2: The font size needs to be increased for all parts of these figures (except for the panel identification). Currently, they are difficult to read without increasing the viewing to 125% or even 150%

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