

## ***Interactive comment on “Effect of grassland cutting frequency on soil carbon storage – A case study on public lawns in three Swedish cities” by C. Poeplau et al.***

### **Anonymous Referee #2**

Received and published: 27 February 2016

Overall, this paper addresses an important topic (the effects of management on soil carbon storage in urban lawns). The authors make a good case for the use of urban lawns as a study system, and bring important attention to the importance of urban areas in biogeochemical cycles and sustainability. The authors find that frequent cutting can increase soil organic carbon stocks, which they attribute to increased NPP. These results will be of general interest to soil ecologists, as well as those interested in urban ecology and sustainability.

While the paper addresses an important topic, and the overarching story appears sound, there are several areas where revision would greatly improve this manuscript.

General comments:

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The introduction to this paper would benefit from a thorough revision for structure and clarity. This includes breaking up the long initial paragraph, clearly defining important terms/concepts throughout, and ensuring statements are backed by adequate evidence (see specific comments). Additionally, while a significant focus of the introduction is focused on the importance of soil carbon and grassland carbon generally, and on agricultural systems, the discussion focuses largely on the importance of urban soils and their role in urban sustainability. More closely matching the tone and scope of the introduction to that of the discussion would greatly benefit the manuscript as a whole.

In the methods, ensure that the study design is clearly and adequately described, as well as the sampling regime. The authors mention “cities”, “areas”, “sites”, “plots”, etc. throughout and it can sometimes be unclear exactly what unit of analysis is being referred to. A figure showing the sampling design (including cities, sites, and plots) would be very beneficial for the reader, here. The frequency of sampling is also unclear, and it is important that this is clarified.

The “statistics” section is far too short, and insufficiently detailed to explain what analyses were done. For example, in this case, I would expect the authors to report: what diagnostic tests were performed on the models, whether any variables were transformed for analysis, the error distribution used for the generalized linear models, dependent and independent variables used in multiple regression, the specific R packages used to conduct the analysis (e.g. lme4 vs. nlme, or other, for mixed effects models?), as well as how p-values were obtained for pairwise comparisons presented in the figures, etc. I advise that the authors review papers conducting similar analyses to determine the appropriate level of detail for this section and thoroughly revise it.

With regards to root biomass and the influence of roots on soil carbon, the authors make some fairly broad generalizations from a relatively minor sampling effort (only the top 10cm were sampled at a third of sites, and only at one time point). Root biomass sampled at one time may not be representative of increased root growth throughout the season (e.g. see Ziter and MacDougall 2013), and changes in root depth may alter

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soil organic carbon. A more nuanced discussion of what can and cannot be inferred from this limited root data is warranted here.

Specific comments:

Abstract: Line 16-17: By “provide a high diversity” do you mean species diversity? Diversity of grassland types? Diversity in lawn management? This sentence is a bit awkward/unclear overall, and should be rephrased for clarity.

Introduction: Line 43: “demonstrated, that” remove comma. Line 44: use of “appropriation” is unclear here – do you mean all human use of NPP? Line 45/46: This sentence is quite vague, please clarify (the effects of different management types? Appropriation of NPP? Line 46: You move somewhat abruptly from general importance of soil C and grassland soil C, to the impact of cutting. Consider starting a new paragraph here? This would help break up your first paragraph, which is quite long. Line 56-60: This is a very long sentence with several ideas. Try and break this down into clearer, shorter sentences. Line 69: Depending on the previous land-use history, urban SOC stocks may continue to change over time – can you necessarily assume equilibrium in all cases? May want to consider whether this assumption holds across different geographical areas/types of cities? (e.g. see Raciti et al. 2011, Golubiewski 2006) Line 70: What do you mean by “functional types” of grasslands? Line 72: Define “lawn”. Does your use of lawn include unmowed meadows/semi-natural grasslands in cities, or only managed/turfgrass areas? Line 80-81: Is this work part of the LAWN project? It is a bit unclear to me why the LAWN project is brought up in this context.

Methods: Line 93: Unclear what you mean by “in each area, triplicate plots of two different lawn types...”. Does “area” refer to city here, or site? E.g. do you mean in each city, 3 sites were established, each site containing one pair of plots (one each of meadow/utility)? Or that within each site, three different plots of each lawn type were established (e.g. 6 total plots per site)? Make sure your study design is clearly described. Line 94: Give some indication (average, range, etc.) of how large the lawns

are in this study. Are plot sizes relatively equal? Highly unequal? If unequal, how did you account for this in your sampling? Line 106: How often was sampling repeated? Was sampling only done after the first mowing, or after each subsequent mowing (in utility lawns)? Line 111: Were sampling locations chosen randomly? Haphazardly? Methodically? Also, were sampling locations consistent with repeated sampling, or did they differ? Line 156: How were 10cm depth bulk density soils taken to an approximate depth of 5-15cm? It is unclear to me what the 5-15cm depth is referring to. Line 174: Was soil texture measured in this study specifically? It is unclear where the soil texture values in Table 1 are from.

Results: Line 210: This sentence is confusingly worded, please rephrase.

Discussion: Line 272-73: See above comments re: root production. Without temporal sampling, it is difficult to assess whether roots could have made a larger contribution that was not detected at a single time point. Line 278-304: ThisS entire paragraph focuses on the role of N in your system, however N is rarely mentioned in the introduction, nor is it included in the study focus at the end of the introduction. As N is an important part of the discussion, consider introducing this topic earlier in the paper. Section 4.3 (Implications for urban soil management): This is an important contribution of your paper. Additional work to consider here is be that of Jill Edmondson, who has published several interesting recent papers regarding urban soil carbon, that would be informative in the context of your work.

Figures and Tables: Please ensure that all axes are clearly labeled (e.g. “Study Site” is missing from the x axis in several figures). In the figure legends, the importance of “stars” is indicated in several figures for which there are no stars present. Ensure that the figure legend clearly describes the figure at hand, and is tailored to each individual figure.

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