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Interactive comment on "Plant communities as drivers of soil respiration: pathways, mechanisms, and significance for global change" *by* D. B. Metcalfe et al.

Anonymous Referee #1

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General comments In this paper Metcalfe et al. review how plant communities impact on soil respiration. The authors do this by addressing the pathways and mechanisms by which plant communities can influence soil respiration and relate their findings to global climate models. The paper discusses how plant characteristics, especially quality and quantity of plant litter, can impact on soil carbon cycling and illustrate potential changes in C cycling associated with plant invasions and plant community diversity. In addition the authors explain to which extend current simulation models of C cycling include plant species characteristics of known potential importance for soil respiration. Last but not least the authors provide an interesting list of critical gaps and guidelines for future research in this field I expect the topic of the paper to be of interest to a wide

readership of Biogeosciences. The paper provides a wide overview of studies and although some elements may not be all that new, the combination of topics does provide a nice overview. The only main remark I have on this paper is that the focus is not really clear. I thought the focus would be on soil respiration, given the title, but after the introduction it appeared to me that most of the text was more about carbon cycling in soil or the C influx rather then about the flux of CO2 that is coming out of the soil (point 2 Plant traits and soil carbon cycling). It would be interesting to get more insight into rates of input/output and the source of the output, respired by roots, mycorrhiza, heterotrophs (of different types) associated with plants with different traits. It may be there in the text already but scattered across the paper so not easy to get a picture of the flux components, a figure, perhaps a reworked version of Fig. 1 could help.

Specific comments Abstract The structure needs to be improved, I think one should first be briefly introduced to the different components of soil respiration and the drivers before the predictions are presented. Now we read about belowground carbon flux but not about the flux out of the soil so it is not immediately clear how the belowground flux links to the focus of the paper which according to the title is soil respiration so the flux from the soil to the atmosphere. Line 11 : 'Within vegetation types, belowground carbon flux will be mainly controlled by photoynthesis' and following sentence are unclear. What do you mean with 'will'? Under which conditions?

Main text Page 2150 and following: Plant traits and soil carbon cycling It would be interesting to get more insight into rates of soil C input/output.

Page 2154 line 11 and 13: 'mycorrhizal hyphae turnover relatively quickly' and 'and contain more recalcitrant structural compounds that inhibit decomposition' please explain as this seems contradicting.

Page 2162 line 19: and what about acclimation by soil biota as they have a strong impact on soil respiration.?

Conclusions Line 5-6: so there is a disproportional increase in respiration relative to

primary production? Otherwise no surprise more respiration with more production and this does not need to imply a positive feedback if rte increases are proportional and counterbalance each other

As with the abstract the conclusion seems to deal more with C cycling in general rather than addressing the components of soil respiration (autotrophic, mycorrhiza, heterotrophic) and how they are impacted by plant communities, across space and time. I suggest to rewriting the first part of the conclusions also such that it better matches the (very interesting) part which lists the critical gaps. The list of gaps could help for some restructuring of the main text.

Figures Figure 1: can soil respiration be included more explicitly? Range of the rate and contribution of the different components (plant roots, mycorrhizae, decomposer soil biota)?

Figure 2: as the manuscript focuses on soil respiration I think a figure showing how soil CO2 efflux (figure f) is related to each of the other factors (those in figures b to e) would be more informative than the current figure.

Figure 3: please include the soil respiration component (the topic of your paper)

Additional or other figures would be helpful to get better insight in what the paper is about. Especially a figure which explicitly shows the pathways of soil respiration, what the underlying sources (with a range of their proportional contribution) are and how they are connect across space and time.

A figure which illustrates the scales (time and space) and methodology (including the resolution and an indication of its variation) used to obtain data on the different components of soil respiration could also be insightful to see the discrepancy between the models and to demonstrate the need to include local processes in more detail for improving global scale models.

References A very relevant reference I missed: Ostle et al. (2009) Integrating plant-soil

interactions into global carbon cycle models Journal of Ecology

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