

## ***Interactive comment on “Microbial respiration per unit microbial biomass depends on soil litter carbon-to-nitrogen ratio” by M. Spohn***

### **Anonymous Referee #2**

Received and published: 20 November 2014

Dr. Spohn submitted a manuscript regarding microbial respiratory quotients ( $q\text{CO}_2$ ) and litter C:N ratios based on a literature compilation. The manuscript is short, simple, and well-focused on an interesting question relevant to Biogeosciences regarding overflow metabolism in soil microbes. The literature search resulted in a relatively sparse dataset (14 studies with 48 observations) relative to other literature reviews of  $q\text{CO}_2$  (e.g., 66 studies and 355 obs, Hartman & Richardson, 2013). However this is to be expected, as Dr. Spohn’s manuscript focuses on  $q\text{CO}_2$  in litter, rather than soil. This is an appropriate choice for this manuscript, as the high C:N ratio of litter relative to microbial biomass is particularly relevant to the subject of overflow metabolism. I enjoyed reading this manuscript, and the results are clear and compelling. However I have some concerns and suggestions that I hope will serve to improve the manuscript.

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Major concerns:

(1) The author introduces overflow metabolism as a controversial subject of current debate; however the existence of overflow metabolism in some organisms is indisputable and has been the subject of several decades of research. Overflow metabolism is clearly supported by molecular biology work in plant mitochondria, as the alternative oxidase and uncoupler proteins allow for the oxidation of organic molecules into CO<sub>2</sub> without a corresponding production of ATP (Atkin et al., 2005; Plaxton & Podesta, 2006). There is also a well-developed literature on overflow metabolism in bacteria, particularly *E. coli*, although the molecular mechanisms seem to be different (e.g., Vemuri et al., 2006). While I understand that the molecular mechanisms are not fully understood in the complex community of organisms that decompose litter, I suggest that the author briefly acknowledge this literature as support for the general concept of overflow metabolism.

(2) Line 53-55. There is little reason to expect overflow metabolism to be forest-specific, so why limit the data compilation to the forest literature? Consider broadening the analysis to include studies regarding litter decomposition in other systems (e.g., grasslands) and residue decomposition in crop systems.

(3) Lines 119-130. This reads like the author is pursuing to discredit the notion of overflow metabolism, when the results clearly support it. I suggest the author clearly state that the results were consistent with overflow metabolism in the decomposition of forest litter, possibly in the first and/or last paragraphs of the discussion section. Furthermore, I am unconvinced by the argument on line 127 that “. . .microorganisms may use C that is in surplus to their demands of somatic growth for promoting their fitness by C storage, buildup of structural defenses, viral repellents or establishment of symbiosis.” The additional processes listed by the author are not infinite C sinks. Consider the case that the microorganisms have already satisfied the C demands of structural defences, viral repellents, etc; what should they do with the “extra” C in this case? The concept of satisfied C demands need not be confined to somatic growth.

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Minor concerns:

(1) The authors report a three-part analysis showing that (1)  $qCO_2$  was positively correlated with litter C:N, (2) basal respiration was positively correlated with litter C:N, and (3) microbial biomass was not correlated with litter C:N. This exploration of the data was very well done. The reader may be able to see this most clearly if point #3 was demonstrated with a figure. Please consider a 3-panel figure with  $qCO_2$ , basal respiration, and microbial biomass all plotted in relation to litter C:N.

(2) lines 106, 113- tense change; consistently use the past tense. It is common practice to discuss previously published literature in the present tense to recognize the current relevance of the established research. However it is more appropriate to discuss the current manuscript in the past tense.

(3) Line 137. "Adapt" has a specific biological meaning that is not appropriate here.

#### References

Atkin OK, Bruhn D, Hurry VM, Tjoelker MG (2005) The hot and the cold: unravelling the variable response of plant respiration to temperature. *Functional Plant Biology*, 32, 87-105.

Hartman WH, Richardson CJ (2013) Differential Nutrient Limitation of Soil Microbial Biomass and Metabolic Quotients ( $qCO_2$ ): Is There a Biological Stoichiometry of Soil Microbes? *Plos One*, 8.

Plaxton WC, Podesta FE (2006) The functional organization and control of plant respiration. *Critical Reviews in Plant Sciences*, 25, 159-198.

Vemuri GN, Altman E, Sangurdekar DP, Khodursky AB, Eiteman MA (2006) Overflow metabolism in *Escherichia coli* during steady-state growth: Transcriptional regulation and effect of the redox ratio. *Applied and Environmental Microbiology*, 72, 3653-3661.

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Interactive comment on Biogeosciences Discuss., 11, 15037, 2014.

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