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Biogeosciences
Discussions

Interactive comment on "Contributions of ectomycorrhizal fungal mats to forest soil respiration" *by* C. L. Phillips et al.

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In this paper, Phillips et al. estimate the contribution of ectomycorrhizal (ECM) mats to forest soil respiration in Douglas-fir stands. The approach of using natural variability in mat density to assess mat properties such as respiration is a good one, as it avoids issues associated with experimental manipulations and lab studies. They estimate that 9% of total soil respiration is contributed by the ECM soil mats (primarily of Piloderma) that they studied. It would be worthwhile to know what other studies have reported for this research site (HJ Andrews Experimental Forest in Oregon) for colonization of Douglas-fir – is it heavily dominated by Piloderma? Or does it have comparatively few root tips colonized, but extensive extraradical hyphal development? It is classified by R. Agerer (2006, Mycological Progress, 5: 67-107, Fungal relationships and structural identity of their ectomycorrhizae) as a short-distance exploration type, but possessing hydrophobic ectomycorrhizae, which is usually associated with more extensive extraradical hyphal development. This paper contributes to ongoing efforts to put the role of ectomycorrhizal fungi into an ecosystem context by providing quantitative estimates of their influence on various ecosystem-scale properties, and as such, will help to constrain recent modeling work that explicitly includes contributions from mycorrhizal fungi (e.g., Orwin K.H., Kirschbaum M.U.F., St. John M.G. & Dickie I.A. (2011). Organic nutrient uptake by mycorrhizal fungi enhances ecosystem carbon storage: a model-based assessment. Ecology Letters, 14, 493-502.)

Chitinase activity correlated with soil respiration. It would be interesting to discuss why the slope of the log/log plot was not one, but 1.48. That is, at higher CO2 effluxes, there is increasingly (CO2ˆ1.48) more enzymatic activity. Is this related to temperature? Although as the authors point out chitinase activity correlates with fungal biomass, it is not the most important fungal carbohydrate, with the proportion of fungal beta-glucans much higher than that of chitin, which is generally no more than 10% of fungal biomass, at least in sporocarps. Thus, it is somewhat misleading to stress the importance of "chitin" as a C and N source. Protein and beta-glucans are probably quantitatively more important as, respectively, fungal N and C sources. Thus (50/10), chitin may be more of an indicator of fungal-derived C and N resources than the actual "driver".

The CO2 sink recorded for the A horizon in non-mat areas at most of the six sampling dates indicated on Figure 7 (and also one date for mat areas) is puzzling. What is the explanation – diffusion of CO2 to shallower or deeper horizons? Loss in soil solution or during uptake by plant roots/mycorrhizal fungi (e.g., R. Teskey work, Aubrey D.P. & Teskey R.O. (2009). Root-derived CO2 efflux via xylem stream rivals soil CO2 efflux. New Phytologist, 184, 35-40,), hydraulic lift? On 1647/10, the authors suggest that aerobic respiration was repressed by moisture – are they suggesting that the environment went anaerobic? What about increased storage of CO2 in water – could that be quantitatively important? For Figure 8, could multiple or stepwise regressions of CO2 production vs. temperature and moisture be useful? On a related issue, the authors appear to hypothesize a shift from ECM respiration to free-living heterotrophic respiration (49/9) and cite the depth distribution of ECM fungi from Erland and Taylor (2002) as justification. This statement appears to confound absolute abundance with relative abundance. The abundance of microbes (including fungi) declines as C concentration declines in soil profiles. However, the relative importance of ECM fungi is less in surficial litter, more important in deeper organic horizons and upper mineral horizons, compared to saprotrophic fungi (Lindahl B.D., Ihrmark K., Boberg J., Trumbore S.E., Högberg P., Stenlid J. & Finlay R.D. (2007). Spatial separation of litter decomposition and mycorrhizal nitrogen uptake in a boreal forest. New Phytologist, 173, 611-620.).

On Figure 5, the temperature profile appears somewhat quantizedâĂŤmaybe just my perception. Please give the r2 for the 3 lines.

Figure 8 in text is referred to as Figure 9.

For Figure 7, give the six dates sampled on graph.

Pages/Lines where additional edits are needed are indicated below.

37/13. Western (lc)

37/22. Substantially “to” total

38/2. Avoid “and/or”. Replace w/ or

38/24. Rewrite dangling participle.

38/25, 27, 28. Use of “incremental” may be confusing. The authors specifically mean (Mat – nonMat)/nonMat x 100%, I think. This should be clearly defined at some point, and use of “incremental” here carefully considered. It is vaguely defined in the legend of Figure 3.

40/7. Genus

42/5 & other lines. O-horizon, C-horizon, etc. should not be hyphenated.

46/10. Is “wet-up” accepted terminology – will non-native speakers understand this?

46/18. Give r2 for figure 6.

47/21. 66% on figure, 68% here.

48/25, 49/8. No comma.

50/2. “advantageously”? check meaning.

50/17. No hyphen.

50/20. Delete “nevertheless”

References.

Genus names need capitals. Also Douglas-fir, NIST.

Interactive comment on Biogeosciences Discuss., 9, 1635, 2012.