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Biogeosciences Discussions

Interactive comment on "Microbial food web dynamics along a soil chronosequence of a glacier forefield" *by* J. Esperschütz et al.

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Dear Editor and Reviewer #2,

The authors like to express their thanks to the anonymous referee#2 for her/his valuable comments in response to the manuscript. We hope that you will find our response satisfactory as we feel that this study provides novel and unique insights into microbial foodwebs under field conditions and thus will be of great interest to the journal audience. We are open to any further suggestions that you may consider necessary.

With regard to the major remark related to the grouping of the different phospholipids into microbial categories (bacteria, protozoa, fungi, etc) rather than in their original chemical groups (PUFA, PLEL, etc.), we would like to point out that we are aware of

other studies where the approach suggested by the reviewer has been followed. However, in our opinion this approach (microbial groupings) can be sometimes misleading as often one group of lipids is present in different microorganisms. For example, PLFA 18:1w9 may indicate fungal abundance, but also appears in bacteria (Bååth et al., 1992; Bååth, 2003); 16:1w5 can be used as indicator for arbuscular mycorrhiza, but may also be synthesized by Gram-negative bacteria (Butler et al., 2003; Olsson, 1999); PLFA 18:2w6,9 was detected in Gram-negative bacteria, fungi but also cyanobacteria, as stated in the manuscript (Nichols and McMeekin, 2002; Zaady et al., 2010; Zelles et al., 1999). A statistical comparison based on microbial groups would therefore be inadequate due to the overlapping indicator values of certain fatty acids. Instead of using the microbial grouping, we decided to use "a group of fatty acids with a similar chemical structure as a bio-indicator for certain micro-organisms" (Zelles et al., 1995), which has been suggested by Zelles and co-workers as an alternative method for interpretation of PLFA profiles. We apologize for this confusion and suggest including this explanation in the PLFA description of the Materials and Methods section. However, to prove that the grouping does not mask the behaviour of individual PLFAs we added an additional figure 1a and 2a to our response, based on means of individual PLFAs of each treatment. In the PLFA description of the Materials & Methods section, we suggest stating that there are "no differences in the PCA analyses between individual PL and grouped PL"; however, "for purposes of illustration chemical grouped PL (based on Zelles et al., 1995) were used in the following study." We think that this is the best way to present the data, but if the reviewer and editor still think otherwise, we are open to accomplish those changes that they may think necessary.

Concerning the general comments, we will provide the requested raw data (PLFA proportions of groups (1a) and individual (1b) as well as δ13C raw data of (1a) groups and (2b) individual PLFA) in the supplemental; furthermore, we will revise the captures of all tables and figures by specifying the investigated samples. In order to comply with the provided technical comments we suggest including the following revisions in the final version:

P1282/20-24 The plant litter material was applied under the vegetation cover. This was done by physically lifting up the soil layer with vegetation cover (specified according to referee #1 ("For this purpose the vegetation cover was physically removed and immediately replaced after litter application to ensure undisturbed conditions during the experimental period."). At harvest, the soil layer with vegetation cover was removed again. In this manner, we took away most roots from vegetation in the samples. Nevertheless, samples were thoroughly screened to remove any root material prior to extraction. The applied plant litter at the two harvesting time points was black and thus easily distinguishable from the soil substrate. Because the litter was placed below the root system, no influence from external litter is to be expected. PLFA analyses of the initial plant litter indicate high contents of PLFA 18:3, which is common in higher plants and roots. In our soil samples, no PLFA 18:3 was detected indicating that roots and litter residues were separated successfully.

P1284/16 We suggest including the following short description into the lipid section and referencing the method with respect to measure isotopes: "According to Wuchter et al. (2003), 13C enriched PLEL isoprenoids indicate archaeal activity. An aliquot of the phospholipids equivalent to 25 g (dry weight) was therefore used for PLEL extraction as described by Gattinger et al. (2003). In brief, after an acidic hydrolysis, ether core lipids were treated with hydriodic acid (57%) for 18 hours at 100°C to cleave the ether bonds. The resulting alkyl iodides were reduced to the corresponding hydrocarbons using 100 mg zinc powder in glacial acetic acid at 100°C for 18 h."

We hope to have addressed all questions and remarks satisfactorily and will include the proposed revision in the final version to be submitted to Biogeosciences.

References not included in the original manuscript:

Bååth, E., Frostegard, A., and Fritze, H.: Soil bacterial biomass, activity, phospholipid fatty acid pattern, and pH tolerance in an area polluted with alkaline dust deposition,

Applied and Environmental Microbiology, 58, 4026-4031, 1992.

Bååth, E.: The Use of Neutral Lipid Fatty Acids to Indicate the Physiological Conditions of Soil Fungi, Microb. Ecol., 45, 373-383, 2003.

Butler, J. L., Williams, M. A., Bottomley, P. J., and Myrold, D. D.: Microbial Community Dynamics Associated with Rhizosphere Carbon Flow, Appl. Env. Microbiol., 69, 6793-6800, 2003.

Olssen, P. A.: Signature fatty acids provide tools for determination of the distribution and interactions of mycorrhizal fungi in soil, FEMS Microbiol. Ecol., 29, 303-310, 1999.

Wuchter C., Schouten, S., Boschker, H.T.S. and Damsté, J.S.S.: Biocarbonate uptake by marine Crenarchaeota, FEMS Microbiol. Let. 219, 203-207, 2003

Zelles, L., Bai, Q. Y., Rackwitz, R., Chadwick, D., and Beese, F.: Determination of phospholipid- and lipopolysaccharide-derived fatty acids as an estimate of microbial biomass and community structure in soils, Biol. Fert. Soils, 19, 115-123, 1995.

Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/8/C1279/2011/bgd-8-C1279-2011-supplement.pdf

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Interactive comment on Biogeosciences Discuss., 8, 1275, 2011.

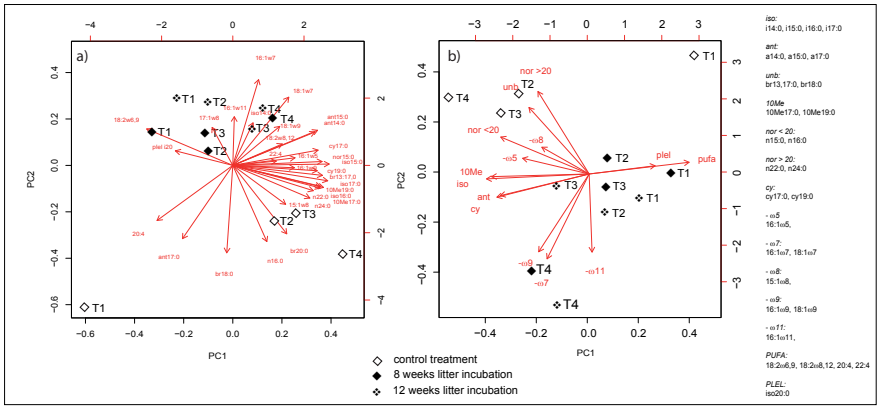

Fig. 1. Illustration of the first (PC1) and the second (PC2) principal component of the principal component analysis (PCA) based on means of the mol% dataset (n=5) of (a) all individual PLFA and (b) PL groups

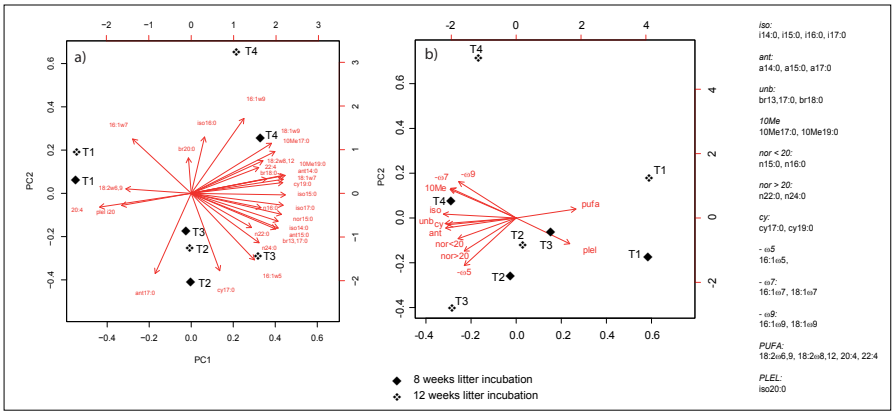

Fig. 2. Illustration of the first (PC1) and the second (PC2) principal component of the principal component analysis (PCA) based on means of the litter derived 13C distribution (n=5) in (a) all individual PLF