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Biogeosciences Discussions

Interactive comment on "Only small changes in soil organic carbon and charcoal concentrations found one year after experimental slash-and-burn in a temperate deciduous forest" *by* E. Eckmeier et al.

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Referee 1 suggested to delete the section that deals with changes in soil colour. We discussed the effect of burning on soil colour because it is of potential interest to soil scientists. The formation of black soils like Chernozems could have been enhanced by the incorporation of charred organic matter. It was exemplified by Schmidt et al. (1999) that dark mollic A horizons contain up to 45% of black carbon, while surrounding lighter soils do not contain any charred material. Charcoal, or its aromatic compounds, are soil colouring agents, but still little is known about the processes of colouring. The correlation of charcoal concentration and soil colour is therefore an essential part of this

manuscript. As proposed by Referee 1, we added a section on (pre)historic slash-and-burn to the manuscript. Pollen data indicated that slash-and-burn was used in Central European forests during Late to End Neolithic, and that forests were burnt to promote certain tree species until the 19th century. The prehistoric techniques of slash-and-burn are unknown, but the technique used in this experiment was common in historical periods (Goldammer et al., 1997). For the time of burning, we can only presume that it happened in autumn or spring to prepare fields for the crops. We do not have any information about the weather conditions favoured by (pre)historic farmers to burn. At the day of our burning experiment, the average temperature was 18.4 °C, the average relative humidity was 71.0 %; no rainfall. We cannot give any information about the fire severity of the burning because we do not know the fire temperature. Further comments on the limitations of our study were added in the conclusions section.

Further comments: (1) We investigated the effects of soil mixing animals on plots situated directly next to our test-plot (micromorphological study). We assumed that the incorporation of charcoal was an effect of animal activity on our plot, too. (2) Westerling et al. (2006) indeed referred to temperate coniferous forests and we changed the sentence. (3) The undergrowth species are characteristic for a woodruff-beech forest (Galio-Fagetum). The topsoil horizon (Ah) was 16 cm thick, and was not covered by a litter layer. (4) We did not apply any spatial analysis before sampling. Only 20 samples were taken because the plot is supposed to be used for a long-term observation and should be disturbed as less as possible. The number of samples was a compromise between sample availability, time for analyses, and reproducibility; we considered the number of samples as sufficient for our investigation. The problem of the burning heterogeneity is also discussed in Eckmeier et al. (2007). (5) The number of replicates does not correspond to the number of replicates in Tab. 2 because we had to discard some of the samples (they were disturbed, e.g. by large root parts). (6) We deleted the bulk density data because it is indeed not useful here.

We changed the title following the suggestion of Referee 2: Minor changes in soil

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organic carbon and charcoal concentrations detected in a temperate deciduous forest a year after an experimental slash-and-burn.

The percentage of the mass burnt converted to charcoal is 4.8 %. This information will be published in Eckmeier et al. (2007), where we compare our results to other studies. In this paper we also discuss that it is difficult to compare the results of a controlled burning to a wildfire. The slash-and-burn experiment produced 6.71 t ha-1 charcoal, while e.g. Ohlson and Tryterud (2000) measured 0.24 t ha-1 charcoal after a wildfire in boreal forest. Compared to the amount of produced charcoal, the changes in SOC and charcoal were small, and a change in biomass burnt would not have a large effect on these changes. However, this is an assumption and needs to be investigated.

Further comments: (1) The results of Spielvogel et al. (2004) were not part of this study. (2) We did not include the N data in the results section because it is not in the scope of our paper to discuss the N budgets. We removed the N data from the table. (3) The trunks and large branches were removed from the site because they do not burn easily. The aims of slash-and-burn are, amongst others, to remove the undergrowth vegetation, kill the weed seeds and leave a charcoal layer on the ground. This was accomplished by pulling stacks of burning dried branches over the plot. The burning did not produce larger charcoals as described by Tinker and Knight (2000), we do not know if larger charcoals could be transported by earthworms, too. (4) The sections dealing with charcoal stocks and bulk density were deleted.

Eckmeier, E., Rösch, M., Ehrmann, O., Schmidt, M.W.I., Schier, W. and Gerlach, R.: Conversion of biomass to charcoal and the carbon mass balance from experimental slash-and-burn in a temperate deciduous forest, The Holocene, in press, 2007. Goldammer, J.G., Montag, S. and Page, H.: Nutzung des Feuers in mittel- und nordeuropäischen Landschaften. Geschichte, Methoden, Probleme, Perspektiven. NNA-Berichte 10, Schneverdingen, 1997. Ohlson, M. and Tryterud, E.: Interpretation of the charcoal record in forest soils: forest fires and their production and deposition of macroscopic charcoal, Holocene, 10, 519-525, 2000. Schmidt, M.W.I., Skjemstad,

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J.O., Gehrt, E. and Kögel-Knabner, I.: Charred organic carbon in German chernozemic soils, European Journal of Soil Science, 50, 351-365, 1999. Spielvogel, S., Knicker, H. and Kögel-Knabner, I.: Soil organic matter composition and soil lightness, Journal of Plant Nutrition and Soil Science, 167, 545-555, 2004. Tinker, D.B. and Knight, D.H.: Coarse woody debris following fire and logging in Wyoming lodgepole pine forests, Ecosystems, 3, 472-483, 2000. Westerling, A.L., Hidalgo, H.G., Cayan, D.R. and Swetnam, T.W.: Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity, Science, 313, 940-943, 2006.

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