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Interactive comment on "Short-term spatio-temporal spring grassland fire effects on soil colour, organic matter and water repellency in Lithuania" *by* P. Pereira et al.

Anonymous Referee #3

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General comments: The paper deals with actual problem of fire impact to soil organic matter and soil water repellency. The paper brings interesting information on duration and post-fire elimination of soil water repellency in association with measurements of soil colour and organic matter content. Thus the paper is aimed to existing gap of knowledge on the post-fire evolution of soil properties and processes in boreal environment. However some aspect should be improved or explained before to be accepted publication.

Specific comments: Page 2121, Line 5 – 9: Sampling must be characterized clearly (sampling times, sampling depths, number of samples at each plot). Line 7 and elsewhere in the text: The term "composite sample" is not appropriate. It is common soil

sample where soil was passed through a 2-mm-sieve. Line 24: Probably you mean "aggregate size" Page 2122: The literature review presented on this page and partly also on the page 2123 can be shortened because many citations are too general and vague, without direct relationship to the subject of the paper. Page 2123, Lines 5 – 21: Give information on the relationship between SOM and Munsell colour properties (hue, value, chroma) as well as on the methods of soil colour measurement used in the reviewed literature. Lines 22 – 29: Give more detailed information on the present knowledge of changes in SOM associated with fire and heat impact (e.g. Atanassova and Doerr, 2011). Especially changes in SOM which are related to the increase of SWR (volatilization, condensation, structural changes, conformation changes, etc.). Page 2124, Lines 3-17: As you stated, it is well known that fire can induce soil water repellency. However, post-fire changes in SWR are not well understood. In the literature review you should emphasize just this aspect. Doerr et al. (2009) stated that more detailed studies are needed to determine (i) the duration of fire-induced SWR in different vegetation types and (ii) the relative roles of physical, chemical, and biological factors in breaking down post-fire SWR. Your paper looks to be focused just on this gap of knowledge! Some papers have been published also on the soil moisture threshold for the loss of SWR. Existing information should be mentioned also in your review (e.g. Doerr and Thomas, 2000; MacDonald and Huffman, 2004). Line 26-27: The aim of the paper should be closely related to the gap of knowledge identified in the literature review. Page 2125, Lines 18-21: Procedure of the colour determination must be described in detail. In the cited paper (Ketterings and Biigham, 2000) the Munsell color charts were not used. Line 26 and elsewhere in the text: The term "composite sample" should be reserved for the samples prepared by mixing of soil samples from a number of discrete subsamples (from different plots). This is not the case of your samples. Page 2126, Line 7: Substitute reference "Mataix-Solera et al. (2013)" with Doerr et al. (2005). (Doerr et al., 2005: Effects of heating and post-heating equilibration times on soil water repellency. Australian Journal of Soil Research, 43, 261-267). Line 22: I am not sure if ANOVA test is the best choice for WDPT values. Even better can be use

of some non-parametric test. In such case, WDPT values need not be transformed. Page 2127, Line 9: The formulation “Soil colour was significantly darker (lower Munsell chroma value)” is unfortunate. You have evaluated Munsell chroma only. But both, Munsell value and Munsell chroma have been reported to decrease with soil heating (in literature). If Munsell hue is the same in all samples, Munsell value is a measure of soil darkness (a smaller value is darker than a larger value) while Munsell chroma can be considered as a measure of soil colour (a smaller value is less colourful while a darker value is more colourful). If possible you can evaluate both parameters in this paper. Pages 2129 – 2130: I am not sure if the transport of hydrophobic substances and charred material into deeper horizons can be so dominant process, especially in the silt loam soil. Intuitively, a leaching of water-soluble nutrients (ions) is a different process compared to translocation of insoluble hydrophobic substances and charred materials. Parts of discussion and references which are not related to your results could be removed (e.g. nutrient availability and leaching, effects on biodiversity). The significant changes of WDPT values occur mainly in first 5 months after the fire. But visually, the changes of Munsell chroma and SOM content (in the burned soil) in first 5 months after the fire (Figs. 1 and 2) do not support your statement about a crucial role of ash leaching for the WDPT decrease. Page 2131, Line 13 - 16: Why do you think that impact of fire on soil (surface) was minimal? What was the soil moisture? Is it possible to distinguish the SWR induced by heat and condensed hydrophobic substances from the SWR caused by admixture of ash? Page 2132, Lines 25 – 26: There is no reason for the conclusion about slower leaching of hydrophobic substances from the fine fractions. The fine fractions were the most hydrophobic immediately after the fire when the SWR was not affected by leaching. Thus it is normal that in this fraction WR will persist for a longer time than in the fractions with much lower initial WDPT values. Page 2133, Lines 28 – 30: How nutrients leached from ash and soil may contribute to the rapid reduction of SWR? Pages 2131 – 2133: At least it is necessary to take into account other processes possibly involved in the WDPT decrease during post-fire period. Water repellency induced by burning may be eliminated by a series of wetting

and drying cycles (Doerr et al., 2009). SWR elimination is often associated with soil moisture exceeding a “critical soil moisture threshold” (demarcating wettable and water repellent states). In addition, Doerr and Thomas (2000) showed that after wetting, SWR is not necessarily re-established when soil become dry again. Decrease of SWR can be related to the changes in the spatial organization of amphiphilic molecules (Horne and McIntosh, 2000; Huras and Schaumann, 2006; Roy and McGill, 2000). The fast breakdown of SWR can be also attributed to greater biological activity and to restoration of vegetation. Table 1: The soil type “Eutric podzoluvisol” is not included in the WRB (2006) system. Your soil probably belongs to Albeluvisols.

Interactive comment on Solid Earth Discuss., 5, 2119, 2013.