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Spatio-temporal effects of low severity grassland fire on soil colour

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Fire changes soil properties directly, through temperature, or indirectly with ash deposition and the temporal elimination of vegetal cover. Both influences change soil colour and soil properties. The degree of changes depends on fire severity that has important implications on soil organic matter, texture, mineralogy and hydrological properties and type of ash produced. The ash colour is different according to the temperature of combustion and burned specie and this property will have implications on soil colour. In addition, ash properties have a strong spatial variability. The aim of this work is to study the spatio-temporal effects of a low severity grassland fire on soil colour occurred in Lithuania, near Vilnius city (54º 42' N, 25º 08' E, 158 m.a.s.l.). After the fire it was designed a plot of 20x20m in a burned and unburned flat area. Soil colour was analysed immediately after the fire, and 2, 5, 7 and 9 months after the fire. In each sampling 25 soil samples were collected, carried out to the laboratory, dried at room temperature (20-24º C) and sieved with the <2mm mesh. Soil colour was observed with the Munsell colour chart and the soil chroma value (CV) was observed. Since data did not respected the Gaussian distribution a neperian logarithmic (ln) transformation was applied. Differences among time and between plots were observed with the repeated measures ANOVA test, followed by a Tukey HSD test. Differences were significant at a $p<0.05$. The spatial variability (SV) was assessed with the coefficient of variation using non transformed data. The results showed differences among time at a $p<0.001$, treatment at a $p<0.01$ and time x treatment at a $p<0.01$. This means that fire during the first 9 months changed significantly soil colour. The CV of the burned plot was lower than the control plot (darker colour), that is attributed to the deposition of charred material and charcoal. This ash produced in this fire was mainly black coloured. With the time the soil of the burned plot became lighter, due the movement of charred material and charcoal in depth through soil profile. After the fire SV was higher in the burned plot (13.27%) than in the unburned plot (7.95%). This major variability might be attributed to ash influence, since this fire did nit had direct effects on soil. Despite the reduced CV, some patches burned at higher severity, and ash was dark and light grey and this might had influences on soil colour SV. In the following measurements SV was very similar, but always slightly higher in the control plot than in the burned plot. Two months, unburned 15.52% and burned, 14.70%. Five months, unburned, 14.78% and burned 14.42%, Seven months, unburned, 15.15% and burned, 14.67%. Nine months, unburned, 18.96% and burned 17.84%. After the fire ash can be (re)distributed uncountable times. In the immediate period after the fire, finner ash produced at higher severities is easily transported by wind and can remix (Pereira et al., 2013a, Pereira et al., 2013b) and change soil colour. In this fire, vegetation recovered very fast, thus this process might occurred only in the first weeks after the fire (Pereira et al., 2013c). Since vegetation recovered fast, soil colour SV depended on carbon and charred material movement in depth soil profile. Further studies are needed on the soil colour evolution after the fire, since can be an indicator of soil properties such as temperature reached with implications in other soil properties.

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