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Spatial distribution of soil moisture and hydrophobicity in the immediate period after a grassland fire in Lithuania

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Fire can affect significantly soil moisture (SM) and water repellency (WR) in the immediate period after the fire due the effect of the temperatures into soil profile and ash. This impact can be very heterogeneous, even in small distances, due to different conditions of combustion (e.g. fuel and soil moisture, fuel amount and type, distribution and connection, and geomorphological variables as aspect and slope) that influences fire temperature and severity. The aim of this work it is study the spatial distribution of SM and WR in a small plot (400 m2 with a sampling distance of 5 m) immediately after the a low severity grassland fire.. This was made in a burned but also in a control (unburned) plot as reference to can compare. In each plot we analyzed a total of 25 samples. SM was measured gravimetrically and WR with the water drop penetration time test (WDPT). Several interpolation methods were tested in order to identify the best predictor of SM and WR, as the Inverse Distance to a Weight (IDW) (with the power of 1,2,3,4 and 5), Local Polynomial with the first and second polynomial order, Polynomial Regression (PR), Radial Basis Functions (RBF) as Multilog (MTG), Natural Cubic Spline (NCS), Multiquadratic (MTQ), Inverse Multiquadratic (IMTQ) and Thin Plate Spline (TPS) and Ordinary Kriging. Interpolation accuracy was observed with the cross-validation method that is achieved by taking each observation in turn out of the sample and estimating from the remaining ones. The errors produced in each interpolation allowed us to calculate the Root Mean Square Error (RMSE). The best method is the one that showed the lower RMSE.
The results showed that on average the SM in the control plot was 13.59 % ($\pm$2.83) and WR 2.9 ($\pm$1.3) seconds (s). The majority of the soils (88%) were hydrophilic (WDPT <5s). SM in the control plot showed a weak negative relationship with WR (r=-0.33, p<0.10). The coefficient of variation (CV%) of SM was 20.77% and SW of 44.62%. In the burned plot, SM was 14.17% ($\pm$2.83) and WR of 151 ($\pm$99) seconds (s). All the samples analysed were considered hydrophobic (WDPT >5s). We did not identify significant relationships among the variables (r=0.06, p>0.05) and the CV% was higher in WR (65.85%) than SM (19.96%). Overall we identified no significant changes in SM between plots, which means that fire did not had important implications on soil water content, contrary to observed in WR. The same dynamic was observed in the CV%.
Among all tested methods the most accurate to interpolate SM, in the control plot IDW 1 and in the burned plot IDW 2, and this means that fire did not induce important inferences on the spatial distribution of SM. In WR, in the control plot, the best predictor was NCS and in the burned plot was IDW 1 and this means that spatial distribution WR was substantially affected by fire. In this case we observed an increase of the small scale variability in the burned area.
Currently we are monitoring this burned area and observing the evaluation of the spatial variability of these two soil properties. It is important to observe their dynamic in the space and time and observe if fire will have medium and long term implications on SM and WR. Discussions about the results will be carried out during the poster session.