Geophysical Research Abstracts
Vol. 13, EGU2011-6186, 2011
EGU General Assembly 2011


# Fire severity effects on ash water repellency in a Lithuanian grassland. Preliminary results

Paulo Pereira (1,3), Jorge Mataix-Solera (2), Xavier Úbeda (1), and Artemi Cerdà (4)

(1) GRAM (Mediterranean Environmental Research Group), Department of Physical Geography and Regional Geographic Analysis, University of Barcelona, Montalegre, 6. 08001 Barcelona (Spain). E-mail: pereiraub@gmail.com, (2) GEA – Grupo de Edafología Ambiental - Environmental Soil Science Group. Department of Agrochemistry and Environment. University Miguel Hernández. Avda. del Ferrocarril s/n 03202. Elche, Alicante Spain, (3) Department of Environmental Protection, Vilnius Gediminas Technical University, Saulėtekio al. 11, LT-10223 Vilnius, Lithuania, (4) Department of Geography. University of Valencia. Blasco Ibañez, 28. 46010-Valencia, Spain

After a wildfire the ash remaining on the soil surface has implications for soil properties, surface runoff, overland flow, and consequently soil erosion and availability of nutrients for plants. In most of the literature, ash is referred to as a highly wettable material. Only recently have studies with ash produced in laboratory and collected from wildfires found that ash can be water repellent, especially at lower temperatures (Bodi et al., 2011). However, this effect is still not fully understood and more studies are needed to accurately assess the effect of fire severity on ash water repellency. The aim of this work is to study the effects of fire severity on ash water repellency in a Lithuanian grassland. Four days after the fire we designed a grid of 27x9 meters and ash samples were taken every 3 meters with a total of 40. During this period, no rainfall occurred. Ash was air-dried in laboratory at room temperature (± 20ºC) during a week and ash water repellency was measured with the water drop penetration time (WDPT) test, placing three drops of distilled water on the surface of each sample and recording the time needed for their complete penetration. Ash colour was identified visually in laboratory. The statistical comparisons were carried out with ANOVA one way test, ash colour as dependent grouping variable and water (WDPT). Neperian logarithmic (ln) transformation was applied to fit normal distribution and was used in statistical analysis, spatial interpolation and probability test. Spatial structure of the ash water repellency was observed with an experimental variogram. Spatial distribution of ash water repellency was assessed testing several well known interpolation methods, namely Inverse Distance to a Power (IDP), with the power of 1, 2, 3, 4 and 5, Local Polynomial (LP) with the power of 1, 2 and 3, Spline with tension (SPT), Completely Regularized Spline (CRS), Multiquadratic (MTQ), Inverse Multiquadratic (IMQ) and Thin Plate Spline (TPS), Ordinary Kriging (OK) and Simple Kriging (SK). In every interpolation method we included a total of 15 neighbours and we applied a smooth factor of 0.5. Interpolation methods precision was carried out with the analysis of the errors obtained from the cross validation procedure, especially the Mean Error (ME) and the Root Mean Square Error (RMSE), the most precise method is the one with lower RMSE. In addition, we calculated the spatial probability of ash water repellency being severe (>61 seconds WDPT) with several probability methods, OK, SK, Indicator Kriging (IK) and Probability Kriging. The assessment of probability methods performance was also carried out with ME and RMSE.
The results showed that the majority of ash was black (57%) and dark grey (43%). All the ash collected was hydrophobic (WDPT >5s) and that the majority (80%) exhibited strong water repellency (WDPT >61 s). We observed that the black ash is significantly less repellent (WDPT=128±33), at a $p<0.05$, than dark grey ash (WDPT=246±38). These results are different from those observed elsewhere (Bodi et al., 2011) and show that other variables have to be studied (e.g. pH, and Total Organic Carbon) in order to have an accurate answer to these different results. Maybe other variables such as ash texture can influence ash water repellency. Among all models, the spherical is the closest to that observed in the experimental variogram and presents a nugget effect of 0.38, a sill of 1.10 along a range of 8.3 m. From all interpolation tests, SK was the most accurate to interpolate ash WDPT (RMSE: 0.9022) and the less precise LP3 (RMSE: 1.0890). Ash water repellency was higher in the Northwestern, Southwestern and Southern part of the plot and lower in the Eastern part of the studied area. The probability of ash water repellency was better interpolated with the IK probability method (RMSE: 0.3598) and less well with the PK probability method (RMSE: 0.3890). The probability ranged from 11.64% to 100% and the spatial pattern reflects that observed in the interpolation method. The higher probabilities were identified in the Northwestern, Southwestern and Southern and the lowest in the Eastern part of the plot. The findings observed in this study show that ash can be hydrophobic especially in low severity fires. This water repellent ash after being incorporated in the soil profile will produce soil water repellency. Further studies are ongoing to explain in detail these first results, especially those referring to the fact that although the fire was of low severity, the most hydrophobic ash

samples were found where there was a higher severity fire.

Reference:
Bodi, M., Mataix-Solera, J., Doerr, S., Cerdà, A. (2011). The wettability of ash from burned vegetation and its relationship to Mediterranean plant species type, burn severity and total organic carbon content, Geoderma, 160, 599–607.