Geophysical Research Abstracts
Vol. 17, EGU2015-2306-2, 2015
EGU General Assembly 2015

Modelling soil sodium and potassium adsorption ratio (SPAR) in the immediate period after a grassland fire in Lithuania.

Paulo Pereira (1), Artemi Cerda (2), and Ieva Misiūnė (1)

(1) Mykolas Romeris University, Environmental Management Centre, Vilnius, Lithuania (paulo@mruni.eu), (2) Department of Geography, University of Valencia, Blasco Ibañez 28. 46010 Valencia, Spain (artemio.cerda@uv.es)

The soil sodium and potassium adsorption ratio (SPAR) is an index that measures the amount of sodium and potassium adsorbed onto clay and organic matter surfaces, in relation to calcium and magnesium. Assess the potential of soil dispersion or flocculation, a process which has implication in soil hydraulic properties and erosion (Sarah, 2004). Depending on severity and the type of ash produced, fire can changes in the immediate period the soil nutrient status (Bodi et al. 2014). Ash releases onto soil surface a large amount of cations, due the high pH. Previous works showed that SPAR from ash slurries is higher than solutions produced from litter (Pereira et al., 2014a). Normally the spatial distribution of topsoil nutrients in the immediate period after the fire is very heterogeneous, due to the different impacts of fire. Thus it is important to identify the most accurate interpolation method in order to identify with better precision the impacts of fire on soil properties. The objective of this work is to test several interpolation methods. The study area is located in near Vilnius (Lithuania) at 54° 42' N, 25° 08 E, 158 masl. Four days after the fire it was designed a plot in a burned area with near Vilnius (Lithuania) at 54° 42' N, 25° 08 E, 158 masl. Twenty five samples were collected from the topsoil. The SPAR index was calculated according to the formula: (Na++K+)/(Ca2++Mg2+)1/2 (Sarah, 2004). Data followed the normal distribution, thus no transformation was required previous to data modelling. Several well know interpolation models were tested, as Inverse Distance to a Weight (IDW) with the power of 1, 2, 3 and 4, Radial Basis Functions (RBF), Inverse Multiquadratic (IMT), Multilog (MTG), Multiquadratic (MTQ), Natural Cubic Spline (NCS) and Thin Plate Spline (TPS) and Local Polynomial (LP) with the power of 1 and 2 and Ordinary Kriging. The best interpolator was the one which had the lowest Root Mean Square Error (RMSE) (Pereira et al., 2014b). The results showed that on average, SPAR index was 0.85, with a minimum of 0.18, a maximum of 1.55, a standard deviation of 0.38 and a coefficient of variation of 44.70%. No previous works were carried out on fire-affected soils, however comparing it to ash slurries obtained from previous works (Pereira et al., 2014a), the values were higher. Among all the interpolation methods tested, the most accurate was IDW 1 (RMSE=0.393), and the less precise NCS (RMSE=0.542). This shows that data distribution is highly variable in space, since IDW methods are better interpolators for data irregularly distributed. The high spatial variability distribution of SPAR is very likely to affect soil hydraulic properties and plant recuperation in the immediate period after the fire. More research is needed to identify the SPAR spatio-temporal impacts of fire on soil.

Acknowledgments

POSTFIRE (Soil quality, erosion control and plant cover recovery under different post-fire management scenarios, CGL2013-47862-C2-1-R), funded by the Spanish Ministry of Economy and Competitiveness; Fuegored; RECARE (Preventing and Remediating Degradation of Soils in Europe Through Land Care, FP7-ENV-2013-TWO STAGE), funded by the European Commission; and for the COST action ES1306 (Connecting European connectivity research).

References

Bodi, M., Martin, D.A., Santin, C., Balfour, V., Doerr, S.H., Pereira, P., Cerda, A., Mataix-Solera, J. (2014) Wildland fire ash: production, composition and eco-hyro-geomorphic effects. Earth-Science Reviews, 130, 103–127.

Pereira, P., Úbeda, X., Martin, D., Mataix-Solera, J., Cerdà, A., Burguet, M. (2014a) Wildfire effects on extractable elements in ash from Pinus Pinaster forest in Portugal. Hydrological Processes, 28, 3681-3690.

Pereira, P., Cerdà, A., Úbeda, X., Mataix-Solera, J. Arcenegui, V., Zavala, L. (2014) Modelling the impacts of wildfire on ash thickness in the immediate period after the fire. Land Degradation and Development. DOI: 10.1002/ldr.2195

Sarah, P. (2004) Soil sodium and potassium adsorption ratio along a Mediterranean-arid transect. Journal of Arid Environments, 59, 731-741.