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Mapping wildfire effects on Ca2+ and Mg2+ released from ash. A microplot analisis.

Paulo Pereira (1,2), Xavier Úbeda (2), and Deborah Martin (3)

(1) GRAM (Grup de Recerca Ambientam Mediterrànea), Department of Physical Geograohy, Barcelona, Spain (Daviolas@gmail.com), (2) Department of Environmental Protection, Vilnius Gedminas Technical University (VGTU), Saulétekio al. 11, LT-10223 Vilnius, Lithuania, (3) 2USGS, 3215 Marine Street, Boulder, Colorado, USA

Wildland fires have important implications in ecosystems dynamic. Their effects depends on many biophysical components, mainly burned specie, ecosystem affected, amount and spatial distribution of the fuel, relative humidity, slope, aspect and time of residence. These parameters are heterogenic across the landscape, producing a complex mosaic of severities. Wildland fires have a heterogenic impact on ecosystems due their diverse biophysical features. It is widely known that fire impacts can change rapidly even in short distances, producing at microplot scale highly spatial variation. Also after a fire, the most visible thing is ash and his physical and chemical properties are of main importance because here reside the majority of the available nutrients available to the plants. Considering this idea, is of major importance, study their characteristics in order to observe the type and amount of elements available to plants. This study is focused on the study of the spatial variability of two nutrients essential to plant growth, Ca2+ and Mg2+, released from ash after a wildfire at microplot scale. The impacts of fire are highly variable even small distances. This creates many problems at the hour of map the effects of fire in the release of the studied elements. Hence is of major priority identify the less biased interpolation method in order to predict with great accuracy the variable in study. The aim of this study is map the effects of wildfire on the referred elements released from ash at microplot scale, testing several interpolation methods. 16 interpolation techniques were tested, Inverse Distance to a Weight (IDW), with the with the weights of 1,2, 3, 4 and 5, Local Polynomial, with the power of 1 (LP1) and 2 (LP2), Polynomial Regression (PR), Radial Basis Functions, especially, Spline With Tension (SPT), Completely Regularized Spline (CRS), Multiquadratic (MTQ), Inverse Multiquadratic (MTQ), and Thin Plate Spline (TPS). Also geostatistical methods were tested from Kriging family, mainly Ordinary Kriging (OK), Simple Kriging (SK) and Universal Kriging (UK). Interpolation techniques were assessed throughout the Mean Error (ME) and Root Mean Square (RMSE), obtained from the cross validation procedure calculated in all methods. The fire occurred in Portugal, near an urban area and inside the affected area we designed a grid with the dimensions of 9 x 27 m and we collected 40 samples. Before modelling data, we tested their normality with the Shapiro Wilk test. Since the distributions of Ca2+ and Mg2+ did not respect the gaussian distribution we transformed data logarithmically (Ln). With this transformation, data respect the normality and spatial distribution was modelled with the transformed data. On average in the entire plot the ash slurries contained 4371.01 mg/l of Ca2+, however with a higher coefficient of variation (CV%) of 54.05%. From all the tested methods LP1 was the less biased and hence the most accurate to interpolate this element. The most biased was LP2. In relation to Mg2+, considering the entire plot, the ash released in solution on average 1196.01 mg/l, with a CV% of 52.36%, similar to the identified in Ca2+. The best interpolator in this case was SK and the most biased was LP1 and TPS. Comparing all methods in both elements, the quality of the interpolations was higher in Ca2+. These results allowed us to conclude that to achieve the best prediction it is necessary test a wide range of interpolation methods. The best accuracy will permit us to understand with more precision where the studied elements are more available and accessible to plant growth and ecosystem recovers. This spatial pattern of both nutrients is related with ash pH and burned severity evaluated from ash colour and CaCO3 content. These aspects will be also discussed in the work.