Spatial modelling of organic carbon in burned mountain soils using hyperspectral images, field datasets and NiR spectroscopy (Cantabrian Range; NW Spain)

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In the North-West of the Cantabrian Range (north of Spain) the climate is oceanic and vegetation cover is continuous. Nevertheless, in the western part of the territory fires are very common, although small in size; their recurrence affects severely to soil properties. Soil organic matter is seriously affected by fires and suffers changes in stock, composition and distribution. In former researches stocks of oxidizable organic carbon increases in these burnt soils (32 Mg/ha in non-burned in front of 90 Mg/ha of oxidizable carbon measured in burned forest soils); however, biochart compounds, which are typically produced by fires, have not been found in all the fire-affected soils. In order to perfect a cartographic technique to identify areas with increases in soil carbon stocks caused by historical fire management we try to test a technique to transfer spectral calibrated model of soil organic carbon to hyperspectral images (AHS sensor).

Total (TOC) and oxidizable carbon (OC) were measured in a population of 89 soil samples. OC mean was 19, 48 with STD 10,32. The samples were scanning with VNIR-SWIR spectrometer (350-2500nm) and chemometric model of OC was calibrated with very high level of adjust (R2 0,85) using Unscrambler 10.3. In order to transfer the chemiometric model to the hyperspectral images the model was recalculated using only the wavelengths present in the hyperspectral images (AHS sensor with cannels in 0,43-1,03;1,55-1,75;1,99-2,54 and 3,3-5,4nm of wavelengths). The most highlighting result was the increase in the adjust of model (R2 0,89) when the wavelengths were restricted between 2200 to 2400 nm. The model was regionalized to a large area using Arc Map 10 and crossing validate with RMSE 10.

Finally, in order to analyze the influence of the relief in the OC landscape pattern the slope steepness was considered. Digital Terrain Model with 10m of resolution was used. Those areas with long, steep hillsides covered with heaths have lower amounts of OC and areas with gentle slopes have greater stocks of OC in soils.