WILDFIRE EFFECTS ON SOIL ORGANIC MATTER COMPOSITION FROM A TYPICAL MEDITERRANEAN FOREST (SW SPAIN)

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Abstract

Wildfire is a frequent ecological phenomenon in Mediterranean ecosystems, which usually affects the physical and chemical properties of soils, and frequently contribute to the loss of soil quality and productivity. Soil erosion risk and lost of habitat of species are also two of the most usual consequences of wildfires. In particular it has been widely documented the quantitative and qualitative changes in soil organic matter (SOM) occurred during a wildfire. For these reasons, the post fire soil management needs to be addressed with caution to avoid further damages. In August 2012, a wildfire affected a forest area of approx. 90 ha in Montellano (Seville, SW Spain; longitude 37.00 º, latitude -5.56 º). The typical species in this area are *Pinus pinaster, Pinus halepensis* and *Eucaliptus globulus*. The dominant soil type in this zone is a Calcaric Haplic Regosols. Burnt trees and plant residues were removed from the fire affected area 16 months after the fire using heavy machinery. Soil samples were taken at different depths (0-1, 1-5, 5-10, 10-15 cm) 1 month and 25 months after the wildfire. Control samples were collected in an un-affected neighbour area with similar physiographic conditions.

The elemental analysis of the soil samples showed that total organic carbon (TOC) content increased on the top layer in the burnt soils sampled 1 month after the fire event. However, TOC and total nitrogen contents decreased 25 months after the fire in the burnt soils. The same was observed concerning the water holding capacity (WHC). In this case, fire caused a reduction of the WHC in the section at 1-5 cm depth. The pH of the burnt topsoils increased, probably due to the presence of ashes. 25 months after the fire, burnt and unburnt topsoil showed similar pHs, whereas the increase in pH was transferred to deeper soil sections, which is probably related with the leaching of ashes. Soil samples were analysed by analytical pyrolysis (Py-GC/MS) and ^{13}C NMR spectroscopy. The results showed enrichment in aromatic compound in the burnt samples, which was still apparent 25 months after the fire. The increased of aromaticity due to charcoal was confirmed by ^{13}C NMR spectroscopy. Analytical pyrolysis showed a reduction in the relative abundance of fatty acids in the burnt soils, which was more pronounced in the second sampling. The average chain length (ACL) of *n*-alkanes as well as *n*-alkenes decreased after the fire probably due to the thermal cracking of the longer homologues. Nevertheless, the samples taken 25 months after the wildfire revealed similar ACL values. In conclusion, fire induced changes in the SOM composition, which may increase the erosion risk. The used of heavy machinery has probably contributed to slow down the possible soil recovery. Nowadays, the vegetation is still very scarce at the burnt area and the loss of soil material and alteration of SOM composition seems to continue. Nevertheless, information from the most recent sampling suggest that factors other than fire,

such as hot and dry periods followed by episodes of heavy rain are contributing to the SOM alteration.

Keywords: Wildfire; soil organic matter; Analytical pyrolysis, ^{13}C NMR spectroscopy.