Geophysical Research Abstracts
Vol. 20, EGU2018-19002, 2018
EGU General Assembly 2018

Soil organic matter and phosphorus dynamic in prescribed fires carried under different Mediterranean ecosystems

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During the last decades, different reasons have led to the accumulation of fuels in different sites from Mediterranean region, in Southern Europe, exacerbating the effects of wildfires, with the subsequent effects on soil degradation. Prescribed fire is an option to decrease the fuel amounts and reduce the recurrence of mega-wildfires. However, there is a lack of information of how these types of fires might affect soil organic matter (SOM) and certain key nutrients, whose cycle is linked to it. This would depend on the of the high temperatures reached during the fires, which is related to the ecosystem conditions (mainly soil moisture), and and type of fire.
Prescribed fires were conducted in two forests one of Pinus nigra and other of Pinus pinaster, and one shrubland of Cytisus oromediterraums. During the fires the temperatures were recorded in the duff and uppermost mineral soil layer. In each location, the levels of soil burn severity (SBS) were determined on the basis of visual indicators of charred organic horizons and surface mineral soil. Changes in OM amount and properties (total content, calorimetric analysis and 13C CP MAS NMR) in the soil organic layer and mineral soils samples (0-2 cm) at the different temperatures and SBS levels were identified and measured. For duff, the data revealed a temperature-induced increase in SOM aromatic compounds and a decrease in other constituents such as carbohydrates and alkyl products. In mineral soils, the effect of fires on SOM quality was much less clear; changes in SOM composition only could be found in the shrub ecosystem, due to the higher temperature achieved in the system (up to 300 ºC). In the unburned organic horizons, the organic P represented 70% of the total P and it was completely mineralized when the temperatures reached above 500 °C. In the unburned mineral soil, organic P forms were very variable, which depended on the SOM content. The organic P content was reduced under moderate SBS levels, when temperatures were higher than 200 °C. The most important losses were found in P monoester. From this data we can conclude that prescribed fires has a higher effect on soil P cycling than on SOM quality.