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Medium term evolution of organic matter in under canopy and bare soils of a Mediterranean environment under different fire intensities

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In response to global warming over the next few decades, fire extent and frequency are expected to increase. Fire affects soil properties and erosion rates differently depending on its intensity. To study the variations in the soil organic matter content (SOM) of a Mediterranean soil burned with different intensities, two fire treatments based on the addition of different biomass amounts were applied on a set of nine plots (20 x 4 m) in the Permanent Field Station of La Concordia, Valencia, Spain. In June 1995, three plots were burned with high fire intensity (T1), three with moderate intensity (T2) and three plots were left unburned to be used as control (T3). Two study periods were considered: first year after the fires impact (June 1995 - June 1996) and seven years after them (January 2002 - July 2003) in two environments: soil under canopy (UC) and bare soil (BS). Plots plant cover was determined at the end of each period. During all the study, runoff and sediment produced after each rainfall event were measured.

Considering both periods, differences in SOM contents were statistically significant between environments: under canopy soils (10.7%) and bare soils (7.8%). Immediately after the fires, SOM values presented different trends depending on the environment and the fire intensity. The highest SOM values were measured in the soils on T1 one month after the fire; but four months after it, pre-fire values were recovered. Contrary, SOM of the soils on T2 decreased one month after the fire, but four months after it their contents were still higher than before fire. Incorporation of ashes with high organic matter content (8.5%) into these soils could explain this fact. One year

after the fires, vegetation recovery was scarce (12% mean plant cover on T1 soils and 9% on T2 soils), SOM values in T1 soils were lower than before them and in T2 soils pre-fire SOM contents were reached.

Seven years later, despite the measured increase in the plant cover on burned soils (T1: 35%, T2: 32%), SOM values in January 2002 were similar to those of summer 1996. In July 2003, burned bare soils reached SOM values lower than unburned bare soils, which had always presented the lowest contents. The unburned soils showed lower SOM contents in the period 2002-2003 than in the period 1995-1996, however these differences were not statistically significant.

In the first year after fires, the runoff (T1: 19.43 L m^{-2}, T2: 14.72 L m^{-2}) and sediment yields accumulated (T1: 561.32 g m^{-2}, T2: 326.16 g m^{-2}) were much higher than those of control soils (3.82 L m^{-2} and 8.44 g m^{-2}). Statistically significant differences were found between T1 and T3 in both erosion parameters. In the period between summer 2002 and 2003, differences in runoff and sediment yields between treatments were still large but not significant.

In the Mediterranean environment studied, incorporation of organic matter into the soil seems to be very slow, in both environments, and the impact of forest fires intensifies erosion processes and increases the desertification risk.