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Soil organic carbon, microbial biomass and basal respiration 11 years after a forest fire in a Mediterranean environment

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Fire can affect soil organic carbon quantitatively and qualitatively, depending on the severity of the fire. Soil microbiota is one of the soil components most affected. A high severity of fire can delay the natural restoration of vegetation and consequently increase the susceptibility to erosion and degradation processes.

Here we report the results of an evaluation of some soil parameters related to soil organic matter in an area affected by a wildfire eleven years ago. Soil samples were collected in burned and a nearby unburned site referred to as control. The study area is located in the province of Alicante (SE Spain). An apparently good and natural reestablishment of vegetation has occurred with the presence of most of the species existing before fire. The vegetation of the area comprised mainly *Pinus halepensis*, *Quercus coccifera*, *Quercus rotundifolia* and *Brachypodium retusum*. The soil is a Calcixeroll developed over Cretacic limestone, with a sandy loam texture, a high content of carbonates (34%), a pH of 8.0 and a 6.7% of organic carbon in the A horizon. Mean annual rainfall is 475 mm and the average temperature range varies from 10ºC (January) to 23.1ºC (August).

Organic carbon (C_{org}), extractable organic carbon (C_{ext}), microbial biomass (C_{mic}) and basal respiration (CO_2-C) were analyzed. Furthermore, some relations between these parameters that are normally used as soil quality indicators have been evaluated. These are: $CO_2\text{-C} \cdot C_{org}^{-1}$, the metabolic quotient (qCO_2) by dividing CO_2-C by the

C_{mic}, $C_{mic} \cdot C_{org}^{-1}$ and $C_{ext} \cdot C_{org}^{-1}$. All the individual parameters showed a decrease in the burned area respect to control (unburned). A 39% less for C_{org} and C_{ext} was found in burned soils. For C_{mic} the decreased found was a 21%. Soil basal respiration (CO_2-C), showed lower values in burned, being in this case a 69% less in relation to unburned soils. The ratio CO_2-C $\cdot C_{org}^{-1}$ showed also statistical differences being a 50% lower in burned soils. Metabolic quotient (qCO_2) showed lower values, as well. No differences were found between burned to control in the ratios $C_{mic} \cdot C_{org}^{-1}$, and $C_{ext} \cdot C_{org}^{-1}$.

The results suggest that directly by the fire or indirectly by post fire soil erosion, a degradation of soil has occurred, demonstrated by the quantitative decreases in all of the soil parameters studied related to soil organic carbon. A relative stabilization in the relations between soil microbial biomass and organic carbon pools seems to be present after these years, because there are no differences in relations that are normally modified by the effect of fire such as: $C_{ext} \cdot C_{org}^{-1}$ and $C_{mic} \cdot C_{org}^{-1}$. However, after eleven years of the fire, the differences found in the ratio CO_2-C $\cdot C_{org}^{-1}$ and in the qCO_2, could be indicating a more recalcitrant organic carbon in the burned soil. This is in agreement with others authors who have reported modifications in the quality of soil organic carbon after burning showing an increased stability to chemical and biological degradation.

We think that it would be interesting to monitor during some years the area to control the evolution of these variables. We should assess if soil organic carbon increases, and see if the differences found in some of the indicators, such as CO_2-C $\cdot C_{org}^{-1}$ and the qCO_2, decrease, besides monitoring the rate of restoration of these indicators.

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