Geophysical Research Abstracts
Vol. 21, EGU2019-7529, 2019
EGU General Assembly 2019

Changes in total and different soil organic matter fractions after the prescribed burning of shrubs in the Central Pyrenees (NE-Spain)

Oriol Ortiz-Perpiñá, Antonio Girona-García, Héctor Martín-Bernad, Clara Martí-Dalmau, and David Badía-Villas

University of Zaragoza, Polytechnic School of Huesca, Department of Agricultural and Environmental Sciences, Huesca, Spain (joseporiolortiz@gmail.com)

Prescribed burnings of thorny cushion dwarf (Echinospartum horridum) are currently performed in the Central Pyrenees (Spain) to recover pasturelands, to reduce wildfire risk and to preserve biodiversity.
Previous works in this area have shown that fire consequences could range from no-effect to a substantial loss of soil organic matter (SOM) and the reduction in the amount and activity of soil microorganisms. Although these effects are very limited to mineral soil surface, they can persist over time up to 2 or even 5 years after burning. In addition to the changes in the amount of SOM, burnings may also affect its quality, therefore influencing the different processes involved in the soil C-cycling.
Our hypothesis was that different types of prescribed burnings would differentially affect diverse SOM fractions, which could subsequently be related to the effects detected on different soil microbiological and biochemical properties.
We have studied three different autumnal burnings in the Pyrenees range. Soil samples were obtained at each site from 0.25 m2 sampling areas at three soil depths (0-1, 1-2 and 2-3 cm) just before (C0) and immediately after the burning (B0), and one year later (B12). In all cases, contiguous points to C0 were sampled to minimize spatial variability and litter and/or ashes were removed prior to sampling. In addition to the quantification of the oxidizable C, the SOM was sequentially extracted by decreasing availability with cold water, hot water, and sodium pyrophosphate, and then the non-extractable residual C has been quantified in the solid residue.
In the prescribed fire where the temperature residence time was the highest (Buisán), burning decreased the total SOM by 68% in B0 and remained below the C0 values (-53%) one year after burning in the 0-1 cm layer, while the 1-2 and 2-3 cm depths remained unaffected. All the studied C fractions were equally affected by fire and only a decrease in pyrophosphate-extractable C and an increase in the non-extractable C were found in the three studied soil depths in B12. In the other prescribed fires, where lower temperature residence times were registered (Asín and Yebra), no effects were detected on total SOM in B0. Nevertheless, the general effect of fire in these burnings was to increase the most labile SOM fractions by reducing the less available C pools. In Asín, where maximum soil temperature and the time with temperatures above 100 ºC were higher than in Yebra, hot-water soluble C increased due to the decrease in pyrophosphate-extractable C. By contrast, in Yebra we found an increase in the cold-water-extractable C due to the reduction in the hot-water-soluble C.
According to our results, slow prescribed burning (Buisán) caused a great loss of SOM in the 0-1 cm soil depth. By the contrary, faster burnings (Asín and Yebra) caused a minor fire effect on total SOM, although qualitative changes were detected, which suggested an increase in the mobility of SOM in the three studied layers.