

EGU22-6043

<https://doi.org/10.5194/egusphere-egu22-6043>

EGU General Assembly 2022

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Wildfire and forest management necessities to avoid soil degradation. A case study in a Mediterranean forest

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Forest management is a common practice to reduce wildfire risk, furthermore in ecosystems prone to fire and where wildfires are recurrent as is the Mediterranean ecosystem. However, few studies were carried out about the effects of pre-fire management in wildfire affected areas and the effectivity of these managements decreasing soil nutrients depletion. The aim of this study is to examine the effectivity of this treatment (clear-cutting operation whereby part of the vegetation was cut and left covering soil surface) carried out before a wildfire that broke out in 2015 and evaluate if the management had influence on wildfire severity of three sites: two exposed to management practices in 2005 (site M05B) and in 2015 (site M15B)–and one that did not undergo any management (NMB) and to compare their properties with those recorded in a Control area unaffected by 2015 wildfire. The fourth areas were sampled and compared 2, 10 and 18 months after wildfire. The study area is located in Ódena (NE Spain). The wildfire occurred at July 27th of 2015 and burned 1237 ha. In each area and in each sampling moment we collected 9 topsoil samples (0-5 cm depth) and analyzed: aggregate stability (AS), soil organic matter (SOM) content, total nitrogen (TN), pH, electrical conductivity (EC), extractable calcium (Ca), magnesium (Mg), sodium (Na), and potassium (K). Two-way ANOVA statistical analysis was carried out to check the differences between managements and time. Results show significant differences (p value < 0.05) between managements 2 months after wildfire in AS, TN, SOM, pH, EC, Ca and Mg; 10 months after wildfire in AS, SOM, pH, EC, Ca, Mg and Na; and 18 months after wildfire in AS, SOM, pH, EC, Ca and Mg. Differences between sampling time were registered in M05B, M15B and NMB for each soil analyzed property. Control did not vary significantly (p value > 0.05) over time due to the absence of fire or manage perturbation. The vegetation removal in M05B decreased the wildfire impact on soil, perhaps due to the fuel load reduction and consequent low fire severity. In this case if forest management is carried out few months before the fire, the impact is strongly reduced as occurs in M15B. High fuel density that we found in NMB site should be managed to avoid high wildfire severity. Overall, the time of forest management previous to fire is a crucial aspect that influence on fire severity and the consequent impact on soil properties. Therefore, this type of studies and knowledge should be taken into account and incorporated when carrying out forest management plans to periodically manage certain areas.