Geophysical Research Abstracts
Vol. 20, EGU2018-15253, 2018
EGU General Assembly 2018

Land abandonment and wildfires effects on soil quality and hydrological connectivity in a terraced Mediterranean catchment

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Wildfires and agricultural activities are relevant factors affecting soil quality, hydrological cycle and sedimentary dynamics. Land abandonment leads to afforestation, which increases fire risk and land degradation. However, no studies have yet evaluated the effect of combining the two factors, which occur frequently in Mediterranean ecosystems. This study assessed the changes in soil quality and in the spatial patterns of connectivity caused by the abandonment of terraces in two microcatchments (<2.5 ha) affected distinctly by wildfires (once and twice burned) and in an unburned control microcatchment. For the assessment, different soil parameters (physical, chemical and microbiological) were examined to obtain several soil quality indices. The index of connectivity (IC) proposed by Borselli et al (2008) and improved by Cavalli et al. (2013) was also calculated using a LiDAR-based HR-DTM (0.9 pts m-2; RMSE < 0.2 m). Soil samples were collected in thirty-six plots (25 m2) representing terraced and non-terraced areas within these microcatchments. Unburned non-terraced plots, in a more advanced stage of ecological succession (Quercus ilex), showed higher organic matter content and higher microbiological and enzymatic activities than other plots. Terraced plots, regardless of fire effects, had much lower soil quality than other plots had. Low organic matter content and low microbial biomass in all terraced plots indicated that agricultural activities in the past still had negative effects on soil quality before the occurrence of wildfires. Fire negatively affected soil quality in both terraced and non-terraced plots. However, microbiological communities had different positive post-fire recovery strategies (growth and activity), depending on the previous soil conditions and land uses, which is indicative of the resilience of Mediterranean soil ecosystems. Although the construction of terraces has been recognized as a very effective soil conservation technique, the lack of maintenance caused changes in the spatial patterns of hydrological and sediment connectivity, favouring runoff concentration and enhanced erosion. As a result, soil organic matter loss and carbonation processes in abandoned terraces were added impacts, hindering soil recovery after the occurrence of wildfires.