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Effects of erosion in the fate of soil organic carbon and soil aggregation in a burned Mediterranean hill-slope

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The Intergovernmental Panel on Climate Change indicated a higher degree of confidence that meteorological conditions associated to climate change will be propitious to increasing extreme events manifested, among others, in bigger and more frequent wildfires (IPCC, 2014). Wildfires contribute to shaping the landscape, and also the geomorphological and hydrological processes that operate on soil are affected (Bento-Gonçalves et al., 2012).
Whereas, it is well documented that wildfires produce significant changes on erosion processes, the associated fate of soil organic carbon (SOC) has received less attention. This research assesses this gap by studying the loss, redistribution, and stabilization of SOC in a Mediterranean forest hill-slope burned the 28-08-2014, with high severity fire, at the Natural Park of Sierra de Espadán, Spain (39°50'45.11"N, 0°22'20.52"W). To this end, soil was sampled (19-9-2014) in the foot's slope (depositional), middle part (transport) and top (eroding) at two depths (<2 cm, 2-5 cm), and in two environments (under canopy soil: UC; bare soil: BS). Sediments were collected from four sediment fences constructed at the foot's slope, and together with soil samples, analysed with regard to SOC content and aggregate stability (AS). The main objective is to increase the understanding on the fate of SOC in Mediterranean burned areas experiencing soil erosion, transport and deposition, with special attention to the role of aggregation and disaggregation in redistribution processes.
Immediately after the fire, SOC content was high (≈50 gC kg-1) as well as the AS (water drop test>146 drops). Significant differences (ANOVA, $p<0.05$) in SOC contents were observed between environments (UC>BS) and soil depths (topsoil>subsoil). However, no significant differences were observed among eroding (58.8+20.8 gC kg-1), transport (67.3+34.4 gC kg-1), and depositional zones (62.0+31.3 gC kg-1), which is not in agreement with other SOC redistribution studies (Wang et al., 2014). Significant differences (Kruskal-Wallis, $p<0.05$) were also found in AS between environments (UC>BS) but not between soil depths or hill-slope positions.
In the first post-fire erosive rains occurred in the area (29-11-14), closest pluviometer (Sot de Ferrer: 4.5 km) registered a total daily rain up to 64.2 l m-2. In this event a total of 12.7 kg of sediment were collected (contributing area ≈0.25 ha), with a content of 252.6 gC kg-1 the total SOC transported or stored in the depositional zone can reach up to 3.2 kg. In the second erosive event (23-3-15: 103.2 l m-2), total sediment in the fences was 143.6 kg, with content of 112.2 gC kg-1, made a total SOC eroded of up to 16.1 kg.
It is hypothesized that fire caused the homogenization of SOC content and AS in the different hill-slope positions, and only when erosion expose unburned organic matter to mineralization processes, SOC losses will increase in eroding sites, likely decreasing in transport and depositional ones. Ongoing work is related to the analyses of organic C in different soil fractions (determined by sieving and density) in order to understand C stabilization in post-fire soil, and its role in disaggregation and SOC redistribution by sediment in different hill-slope positions.

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