



Impact of fire frequency on runoff, sediment and organic matter losses at micro-plot scale in north-central Portugal

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High intensity and fast spreading wildfires are one of the key factors in Mediterranean ecosystems. However, since 1960 land use changes and land abandonment have resulted in a higher wildfire frequency. They have not only a strong impact on the vegetation but, may also lead to irreversible soil degradation. Therefore, assessing the impact of repeated wildfires on soil degradation is critical. Therefore, this study addresses the effects of repeated wildfires on soil cover, runoff, soil erosion and related organic matter (OM) losses in Maritime Pine forests lead to land degradation.

After a large wildfire in September 2012, we selected three control sites (C) unburnt since 1975, three degraded sites (D) suffering from wildfires three more times before 2012 and three semi degraded sites (SD) only affected by wildfire in 2012. We installed 9 microplots (0.25m²) at each site and collected runoff, eroded soil and organic matter in barrels after each rainfall event during October 2012 till September 2014.

Initially, soil surface of D was covered 100% by a 5 cm ash layer, after 2 years the ash coverage was still 46% and vegetation cover a 14%. Soil surface at SD initially was 95% covered by ash, after 2 years it changed to 53% ash and a vegetation cover of 13%. The soil surface of C initially was covered by 100% litter in the begin and 83% of the litter and 17% of vegetation after 2 years.

The results show clearly the impact of fire frequency on runoff, OM and soil losses. Associated to maximum rainfall intensities of (23 mm.h⁻¹ in 2013, 29 mm.h⁻¹ in 2014) via annual rainfall of (1289 mm in 2013, 1628 mm in 2014) yearbook average runoff coefficient was the highest in D (25% in 2013, 40% in 2014) comparing to SD (6% in 2013, 10% in 2014) and C (4% in 2013, 2% in 2014). Annual average erosion for the first year in D was significantly higher than in SD with losses of 2.57 versus 0.31 Mg ha⁻¹ and for the second year by 3.79 versus 0.84 Mg ha⁻¹. No erosion or OM losses occurred in C due to the 100% soil cover. Annual average of OM losses in D was significantly higher with 1.29 Mg ha⁻¹ in 2013, 2.32 Mg ha⁻¹ in 2014 than in SD with 0.14 Mg ha⁻¹ in 2013 and 0.37 Mg ha⁻¹ in 2014.

Repeated wildfires strongly increase the runoff coefficient and therefore the risk of flooding's in downstream regions after strong rainfalls. Total erosion rates did not exceed threshold values for soil erosion (8 Mg.ha⁻¹) in all sites, however the transport OM loss was extremely high in the degraded sites due to the runoff related ash transport.