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Post-fire runoff and soil (fertility) losses in long-unburnt vs. repeatedly-burnt Maritime Pine stands, north-central Portugal

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Whilst wildfires are a natural phenomenon in Mediterranean climate regions and a key evolutionary and ecological factor in several of its ecosystems, there are widespread concerns about the resilience of even these fire-adapted ecosystems under present-day fire regimes. The role of repeated wildfires in land degradation, however, has not been extensively studied. The EU-funded CASCADE project addresses this research gap in the study case in Portugal, assessing whether repeated wildfires in Maritime Pine stands lead to land degradation through a gradual process or, instead, through tipping-points in plant-water-soil relationships. In the present study, focus is on the indirect effects of (repeated) wildfires, due to fire-enhanced overland flow generation and the associated losses of sediments, organic matter and nutrients (N and P). Following a large wildfire in early September 2013, affecting roughly 3000 ha in the municipality of Viseu, six Maritime Pine stands were selected within the burnt area. According to the available burnt-area maps, covering the period 1975-2011, three of these sites were unburnt for over 35 years, whereas the other three sites had burnt three more times before 2012. At each of these sites, two pairs of micro-plots of approximately 0.25 m2 were installed as soon as possible after the wildfire, albeit not before the first two post-fire rainfall events, whilst a third pair was installed several weeks later. The first two plot pairs were installed halfway the upper and lower halves of the slope, the third pair in between. The paired-plot design was chosen to compare the hydrological and erosion response for two adjacent patches with contrasting post-fire vegetation recovery processes, i.e. through re-sprouting (by the shrub Pterospartum tridentatum) and by germination. Since the installation of the plots, runoff has been measured at 1- to 2-weekly intervals, depending on rainfall, and samples taken for laboratory analysis of sediment and organic matter loads as well as total N and P concentrations. The field and laboratory results are still being analyzed but personal observations suggest that overland flow generation is markedly higher at the repeatedly burnt than long-unburnt sites.