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Effect of wetting-drying cycles and fire conditions on runoff and soil loss of a Mediterranean Pale Rendzina

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Wetting and drying cycles have been reported to have a positive effect on soil aggregation and improve the recovery of soil structure after a disturbance. Therefore, after wildfires, it is expected that drying periods between consecutive storms could modify runoff and soil loss patterns. At the same time, different fire conditions may coexist in a location during a wildfire, creating a mosaic of soils affected to different degrees. The objective of this study was to analyze the effect of wetting-drying cycles and various fire conditions on infiltration rate, runoff and soil loss of a Mediterranean soil. Samples from a Pale Rendzina from Birya forest in Northern Israel were subjected to treatments representing some of the soil disturbances that may coexist after a wildfire: unburnt (UB-soil, i.e. not affected by fire); low-moderate severity direct fire (direct fire-DF soil) and; prolonged heating under moderate temperature without direct contact with the flames (oven heated-HT soil). Each soil was placed under a rainfall simulator and exposed to three 80-mm storms separated by drying periods of 72h. Significant differences were found between fire conditions in infiltration rate, runoff and soil loss. Runoff and soil loss were in the following order :HT<DF<UB. Since the Pale Rendzina showed very low water repellency, the lowest runoff and soil loss of the HT soil were a result of its higher structural stability, likely emerging from the thermal fusion of clay particles in the aggregates, and from changes in the soil solution that reduced clay dispersion. This was confirmed by data obtained from slaking and dispersion tests. Wetting and drying cycles did not have a positive effect on runoff or soil loss. Total runoff and soil loss from the UB soil remained relatively constant in the three rainstorms, while those of DF and HT soils increased significantly from one rainstorm to the next. Therefore, the differences between fire conditions became smaller as the number of rainstorms increased. These results indicate that the exposure of the Pale Rendzina to heat or direct fire produces an increase in its stability, which is progressively reduced during consecutive rainstorms.