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Medium-term evolution of water repellency and aggregate stability in Mediterranean calcareous soils after wildfire

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INTRODUCTION

Wildfires are a common feature of Mediterranean ecosystems due to environmental factors and anthropic influence, especially in those areas where land use change and the development of touristic infrastructures are more intense. Wildfires induce a series of soil changes affecting their physical and chemical properties and the hydrological and erosive response. Two of the properties that are commonly affected by burning are soil water repellency (WR) and aggregate stability (AS). Both properties play an important role in the hydrological response of soils and other processes, and may be used as indices for assessing burn severity (Gordillo-Rivero et al., 2013).

OBJECTIVES

The field study was carried out between August 2006 (date of burning) and August 2011 with the following objectives: [i] to study the changes in SWR and AS immediately after fire and in the medium-term (6 years after burning) and its distribution within aggregate size fractions (<2, 1-2, 0.5-1 and 0.25-0.5 mm), [ii] to assess the relationships between postfire AS and WR, and [iii] to investigate interactions between AS and WR and different factors (site, time since burning, lithology and vegetation type) in calcareous Mediterranean soils.

METHODS

Five areas affected by wildfires during summer 2006 were selected for this research. Vegetation was characterized by grassland and Mediterranean shrubland. Soils were calcareous, with loam to clayey texture. As shown from adjacent areas, soils were wettable or slightly water-repellent immediately before burning.

Soil WR and AS were measured in soil samples (0-15 mm deep) in fine earth (<2 mm) and aggregate sieve fractions (1-2, 0.5-1 and 0.25-0.5 mm). WR was assessed using the WDPT test, and AS was determined as the percentage of stable aggregates after laboratory rainfall simulation.

RESULTS

Both properties showed different tendencies in different aggregate size fractions. Results showed that soil WR was induced in wettable soils or enhanced in slightly or moderately water-repellent soils after moderate severity burning. WR increased after fire especially in the finer fractions (0.25-0.5 mm) immediately after fire, and WR from finer aggregates (0.5-1 and 0.25-0.5 mm) varied or remained stable during the studied period, but did not contribute to general soil WR assessed in the fine earth fraction.

AS increased significantly after the fire and was progressively reduced during the experimental period. Both properties returned progressively to pre-fire conditions during the study period. Soil resilience to low-moderate severity burning in the study area was very high.

REFERENCES

Gordillo-Rivero, A.J., García-Moreno, J., Jordán, A., Zavala, L.M. 2013. Monitoring fire impacts in soil water repellency and structure stability during 6 years. FLAMMA, 4(2):71-75.