

Plant species impact on runoff and soil erosion in a Mediterranean shrubland

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Abstract

Shrubland is a Mediterranean biome characterized by densely growing evergreen shrubs adapted to fire events. To date, scientific research has focused on the impact of vegetation on soil erosion mainly through the control that plant biomass or plant cover exerts on sediment delivery and runoff discharge, being the individual plant species' influence on hydrological and erosional processes not achieved in detail. The objective of this research is to determine: i) runoff and soil losses in shrubland-covered rangeland at Sierra de Enguera, Spain; and ii) how four plant species affect soil and water losses. We measured soil cover, soil properties, runoff discharge and sediment yield under natural rainfall for five years (2010-2014) in a typical shrubland burnt in 1999. Four plant species were selected with 4 plots each: *Ulex parviflorus* Pourr., *Pistacia lentiscus* L., *Quercus coccifera* L., and *Rosmarinus officinalis* L. Despite that the soil properties and plant cover did not exhibit statistically significant differences among plant species, the runoff discharge was lower on *Q. coccifera* (4.87 %, SE 0.24) and *P. lentiscus* (6.24 %, SE 0.51) than on *U. parviflorus* (13.41 %, SE 0.58) and *R. officinalis* (13.84 %, SE 1.23). Sediment concentrations were, respectively, 3.91, 4.33, 4.31, and 4.88 g l⁻¹, and the differences between *R. officinalis* and the other species were statistically significant. The runoff discharge determined differences in soil erosion rates amongst the plant species with lower rates on *P. lentiscus* (1.36 Mg ha⁻¹ y⁻¹) and *Q. coccifera* (1.53 Mg ha⁻¹ y⁻¹), than on *U. parviflorus* (3.17 Mg ha⁻¹ y⁻¹) and *R. officinalis* (3.85 Mg ha⁻¹ y⁻¹). This long-term in situ study indicated that *Q. coccifera* and *P. lentiscus* are more efficient in controlling runoff discharge and soil losses than *U. parviflorus* and *R. officinalis* one decade after a fire. We discuss these results in light of the recent findings by the scientific community on the role of the canopy cover (rainfall interception), soil macropore and root system, and the water repellency that controls the hydrological response of the soil (e.g. runoff generation, infiltration). The information supplied by 5 years of research is relevant for restoration and rehabilitation programs and advises that *Q. coccifera* and *P. lentiscus* are

the most efficient plant species to control soil and water losses within the Mediterranean shrubland. This is an applied science approach for the better management of rangelands.

Keywords: Plants, Shrubland, Plots, Rainfall, Runoff, Soil erosion, Sediment; Mediterranean

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