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On the estimate of the Vegetation effects on the surface runoff through a plot scale rainfall simulator in Sardinia, Italy.

R. Corona (1), N. Montaldo (1), C. Cortis (1), and J.D. Albertson (2)

(1) Cagliari, Ingegneria del Territorio, Italy (roberto.corona@unica.it), (2) Department of Civil and Environmental Engineering, Pratt School of Engineering, Duke University, USA

In semi-arid regions with the Mediterranean climate of cool, wet winters and hot, dry summers, precipitation timing and amount, vegetation growth, and surface runoff are tightly intertwined. In the experimental site of Sardinia, the main source of water is surface reservoirs that are recharged by surface runoff in the rainy winter season. However, changes in climate are expected to bring both an overall decrease in winter precipitation and increased interannual variability of precipitation to this region. These changes may affect characteristics of the water-limited vegetation growth such as timing and production, and consequently change the amount of overland flow and reservoir recharge. Currently, there is little research on the combination of these effects; therefore, the goal of this research is to assess the runoff response of the land surface with varying vegetation states to ultimately predict how changes in the climate of Mediterranean watersheds may affect the needs of water resource management. A 4 m by 4 m rainfall simulator was designed, constructed, and tested as the first stage of this research. The rainfall simulator consisted of four independent lines of low-cost pressure washing nozzles operated at a pressure of 80 mbar, with the number of nozzles determining the rainfall intensity delivered to the plot. The rainfall intensity of the simulator varies from approximately 26 to 52 mm/h with a coefficient of uniformity ranging from 0.40 to 0.59. Measurements taken include surface runoff using a tipping bucket flow meter and soil moisture throughout the plot. Literature models for surface runoff predictions (Philips, Horton, Green Ampt, Soil conservation Service model, bucket model) are widely tested highlighting the typical hortonian behavior of this soil. The simulator was used to monitor changes in the surface runoff throughout the seasons (July 2010, August 2010, June 2011, July 2011, December 2011, January 2012) as the vegetation changes. Results shows the great impact of changes in vegetation cover on soil runoff processes: the increase of LAI from values of 0 to 1.5 produces a decrease of surface runoff of the 50%.