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Abstract

Soil Water Balance and Vegetation Dynamics in a Semi-arid Mediterranean Ecosystem †

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Under arid conditions, where water availability is the limiting factor for plant survival, water balance models can be used to explain vegetation dynamics. Here we analyze for the first time measurements from the precipitation exclusion experiment of the CASCADE Project [1] study site of Messara Valley, in Crete, Greece. The site is located in a marginal grazing land of patchy macchia vegetation on the fringe of the most important agricultural region of the island. Soil water content was monitored under and outside the canopy of 3 control *Hyparrhenia hirta* plants at two depths (2.5 and 15.0 cm below ground) using 12 EC-5 time-domain reflectrometry (TDR) sensors. Measurements were employed to calibrate a simple water balance model that uses rainfall and air temperature as input to predict soil moisture conditions [2]. Results show that the model can capture and quantify the significant effect of shallow rooted macchia patches on soil properties that control water content at the top 2.5 cm of soil during the drying process. On the other hand, at the deeper soil layer (15.0 cm), vegetation presence effect was negligible. An analysis of the model sensitivity to meteorological variables showed that surface soil under canopy was easiest to perturb by both precipitation and temperature changes during the wet season (October-April), part of which also coincides with a critical growing stage of the macchia vegetation. Following the climate change patterns foreseen for the Mediterranean [3], showing a precipitation reduction in the area of 10% and a temperature increase of 2 °C, we predict a reduction of soil moisture by about 15% during the wet season. Modeling results will be used as background data for the precipitation exclusion experiment that aims to identify sudden changes in ecosystem structure and function caused by climatic shifts.

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