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## The water balance of two semi-arid shrubs on abandoned land in South-Eastern Spain after cold season rainfall

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**Abstract.** The inland, mountainous marginal areas (land abandoned by farming and colonised by shrubs) of the Iberian Peninsular, Spain, generally receive a higher rainfall than the coastal areas (Lazaro and Rey, 1991) and may store water after cold season (autumn and winter) rainfall. By measuring runoff, change of soil water content and rainfall, this study tests the hypothesis that two shrubs on two sites on abandoned land do not use all the water available after cold season rainfall. One site was on an upper alluvial slope dominated by *Anthyllis cytisoides* and the other on a lower alluvial slope dominated by *Retama sphaerocarpa*. The root systems of *A. cytisoides* and *R. sphaerocarpa* penetrate to 3 m and 20 m, respectively. *A. cytisoides* senesces during the dry season and *R. sphaerocarpa* is evergreen. The water balance is dominated by high actual evapotranspiration (ET), which is limited by rainfall. Reference evapotranspiration was high; runoff was low and soil water storage occurred above 2 m depth. ET and water storage were highest under *A. cytisoides* shrubs. Runoff was lower on the 'Anthyllis' site. The spatial variability of soil water is high and the problems of its measurement are discussed. The quantity of rainfall infiltrated was greater under shrubs than grass-areas, suggesting that shrub roots facilitated preferential flow. The growing season of *A. cytisoides* began when water was available in the upper soil layers and senescence occurred when the upper soil layers dried to less than 4% water content. *A. cytisoides*, therefore, relies on water from these layers. The main growth of *R. sphaerocarpa* occurred when the upper soil layers were relatively dry, so that *R. sphaerocarpa* must extract water from deeper layers. Results suggest that *A. cytisoides* accumulates rainfall and runoff and directs water to lower layers for later use, while *R. sphaerocarpa* extracts water from deeper soil layers. By mid-summer both shrubs had extracted all the available water accumulated in the upper soil layers from cold season rainfall.

**Keywords:** water balance, neutron probe, patchy vegetation, mosaic vegetation, Spain, semi arid, *Anthyllis cytisoides*, *Retama sphaerocarpa*

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