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Relationship between soil-water content and hedgerow root-distribution pattern in the unsaturated zone

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Hedgerows are one of the most important landscape configurations throughout the world, especially in Europe. The aim of this study was to investigate hedgerow impact on soil-water movement. We analysed the relationship between root-distribution patterns and soil-water content. The hedgerow studied was perpendicular to a slope, ran north-to-south, and represented the boundary between two contrasted domains: a hillslope domain with well-drained soils and a bottomland with waterlogged soils. Soil-water potential was measured at 15-minute intervals for 18 months at different depths and distances from the hedgerow. Soil-water content was calculated from soil-water retention curves. In addition, sapflow within the hedgerow was measured using a thermal-dissipation probe method. Horizontal and vertical distribution of roots was described in two trenches 2 m deep and 28 m long perpendicularly. Trenches were 2-16 m distance in the upslope zone and 2-12 m for downslope. Results showed that variations in soil-water content were related to the hedgerow root-distribution pattern. In the horizontal plane, 70% of roots were located within 8 m of the hedgerow and 30% were located 8-16 m away from the hedgerow. In the vertical plane, within 8 m of the hedgerow, 64% of roots were 20-50 cm deep and 32% were 50-100 cm deep; only 2% were 100-200 cm deep. At distances 8-16 m from the hedgerow, 50% of roots were 10-50 cm deep, 45% were 50-100 cm deep, and 5% were 100-200 cm deep. In the downslope zone, roots were observed only in the topsoil layer (10-50 cm deep) within 8 m of the hedgerow. Vertical variation in soil-water content was related to the root-distribution pattern. During summer and autumn, soil-water content varied spatially according to its distance from the hedgerow, whereas in the winter, soil-water content was higher near the hedgerow due to the topography of study site. During summer and at the end of spring, when transpiration was highest, the soil-water content

near the hedgerow (4 m distance) reached its lowest levels at depths of 50 and 100 cm, where maximum root density was located. Our results show that hedgerows influence soil-water content due to root presence and soil-water spatial distribution is clearly related to root-distribution pattern. Root-water uptake controls water movement in soil layers with high root density. Thus, hedgerows clearly contribute to water transfer in the unsaturated zone. Hedgerows reduce water-table recharge by root water-uptake and participate in water-table discharge by decreasing the water level, especially during summer. Such processes are crucial factors in the hydrological cycle. Keywords: hedgerow network, root-distribution pattern, soil-water content, soil-water transfer.