

Hydrological performance of an extensive green roof: a case study from the central Europe (Bustehrad, Czech Republic)

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Extensive green roofs with a thin growing medium require minimal maintenance, and in general no irrigation. The proper functioning of such systems rests with their structural constituents, especially with the substrate used for planting.

An extensive green roof with poorly developed vegetation and with a soil layer of a maximum thickness of 5 cm mixed with local stripped topsoil with crushed bricks and green waste was studied with respect to the hydrological behavior. The substrate classified as loam comprises a significant proportion of very fine particles and thus it is prone to clogging up of soil pores and forming of fissures on the surface. The green roof studied is well equipped for measuring meteorological data including air temperature, wind speed and direction, net radiation, relative humidity, and rainfall intensity. The meteorological information on the site is completed by soil temperature measurement. The 12 m long transect is equipped with eight time domain reflectometry probes (TDR) to monitor soil water content. Soil physical properties (bulk density, porosity, grain size distribution) and soil hydraulic characteristics (soil water retention curve) were obtained. The numerical modeling of transient soil water movement in the green roof substrate was performed using a two-dimensional model based on the Richards' equation. Results were compared with the soil water content data acquired. Six alternative scenarios were formulated to discuss possible improvement of green roof functioning and four selected scenarios were simulated.

The study helped us to improve our understanding of the flow processes through the green roof soil system under study. The alternative scenario simulations allowed hydrological assessment of roof construction amendments.

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