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Infiltration and water storage in forest soils at the plot and the micro-catchment scale

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Tree roots generate and conserve hydrologically active macropores. We explored the influence of root density on infiltration and water storage at six 1-m2 plots along an 8-m transect between two mature trees (spruce). The soil is a Flysch-based stagnic Cambisol with a flow-impeding horizon at a depth of about 60 cm. At a plot the experimental set up consisted of a 1m x 1m sprinkler and five Decagon HS-10 soil-moisture probes that were horizontally mounted from a trench into the centre of each horizon. We irrigated each plot three times at 24-hour intervals during one hour with a rate of 70 mm h-1. Data logging was at 60-seconds intervals that produced time series of water contents due to irrigation and drainage. After irrigation, soil cores of 10 cm diameter were sampled. Roots were extracted from the cores and their densities were optically analysed with the program “whinRIZO”. The application of a rivulet approach to the time series of water contents produced the thickness F (µm) and the specific contact length L (m m-2) per cross-sectional area of the water films that represent Stokes-flow. The procedure leads to estimates of storage capacity and hydraulic connectivity in the vertical and lateral directions along the transect. Extrapolation from the transect to the micro-catchment scale is based on maps showing the spatial arrangements of trees, shrubs and soil properties like thickness and hydrological parameters of horizons.