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Effect of vegetation on infiltration into sandy soils during wet and dry spells

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Plant cover can influence the hydraulic characteristics of soil considerably. Water repellency, which commonly evolves in sandy soils during longer dry spells, can result in water infiltration retardation. Water infiltration into natural-meadow, pine-forest, glade and fallow sandy soils was evaluated after during several wet and dry spells in respect of: soil porosity, hydraulic conductivity and sorptivity estimated by mini-disc infiltrometer, water drop penetration time, effective contact angle and water repellency index. Bare aeolian sand containing practically no organic matter was taken as etalon material. All materials have similar texture and pore-size distributions but their wettability and hydraulic properties differed considerably. Long dry spells enhanced the infiltration capacity in wettable etalon material because of sorptivity increase. Sorptivities of meadow and fallow soils, however, remained restrained during both, wet and dry seasons either due to higher water content (when wet) or to stronger water repellency (when dry). For this reason no temporal variability of infiltration capacity was observed in these soils unlike the etalon material. It was confirmed (for the fallow soil) that subcritical water repellency can significantly retarded water infiltration.

The infiltration rate vs. time relationships measured both in the laboratory and field for the grass site revealed different behaviour in the initial phase of infiltration. In the laboratory, the onset of infiltration depended on the water ponding depth. As is often found in water repellent soil, the infiltration rate increased with time as a result of fingered flow. In the field, infiltration started immediately after the water application. This was the result of temporarily stable wetting patterns observed in all studied water repellent soils.

Important founding is also that substantial part (71%) of the hydraulic conductivity variation in meadow soil could be explained by the variation of mean WDPT observed around the installed infiltrometer. The same was observed also for some other types of vegetation examined (pine forest, mosses and lichens on glade).

However, no correlation existed between hydraulic conductivity and water repellency index possibly due to macropore flow dominating over the saturated hydraulic conductivity measurements.