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The effect of different fire temperatures on the water repellency parameters of forest soil under different types of vegetation

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Abstract

Soil under specific tree forest species (e.g. pines) can be water repellent. Fire can create, strengthen or destroy soil water repellency (SWR). SWR is considered important to post-fire hydrology. The three study sites were located in the Borská nížina lowland (southwestern Slovakia). The first site SP1 was under a coniferous 100-year-old stand of Scots pine (*Pinus sylvestris*), the second site SP2 was in a 30-year-old stand of Scots pine (*Pinus sylvestris*) and the third site A1 under the deciduous stand with a predominance of alder (*Alnus glutinosa*). The disturbed mineral soil samples were taken from 2.5 - 5.0 cm depth of soil horizon. The organic horizon (0 - 2.5 cm) was sampled separately before mineral soil. In the laboratory, the mineral soil was sieved through a 2 mm sieve. After drying at 40 °C, the samples from each site in 5 replicates were placed into a muffle furnace and exposed to a temperature from 50 to 900°C for 20 minutes. The persistence of water repellency in soil samples was measured using the water drop penetration time (WDPT) test. The mean value of WDPT at SP1, measured after we dried the samples at 40 °C was 15 480 s (extremely water repellent class of WDPT); at SP2 it was 958 s (severely water repellent) and at A1 it was 146 s (strongly water repellent). Consequently, the SWR at SP1 raised slightly with the increasing heating temperature and it reached the highest value of WDPT at a temperature of 100 °C. After reaching its maximum, it dropped slightly at 350 °C and completely disappeared at 375 °C. At SP2, the SWR was decreasing to a value measured at temperature of 200 °C. At a temperature of 250 °C the SWR increased significantly and reached the maximum. The SWR disappeared at a temperature of 350 °C. At A1 the SWR after initial drying of the soil was lower than after heating in the furnace. From a temperature of 250 °C, the SWR increased significantly up to a temperature of 350 °C, when the maximum was reached. Subsequently, the SWR disappeared at 375 °C.

Keywords: soil water repellency, soil heating, water drop penetration time, forests

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