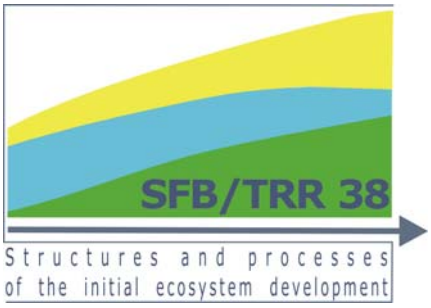

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How do biological soil crusts influence hydrological processes in initial ecosystems?

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Abstract

During initial ecosystem development vegetation cover is sparse, but the space between shrubs is not bare and is often covered by biological soil crusts (BSC) composed by cyanobacteria, green algae, mosses and lichens. These cryptogames are the first colonizer of initial ecosystems. BSC accumulate the first soil organic matter and influence the hydrological processes (Fischer et al. 2010a, 2010b).

In southern Brandenburg (NE Germany) it was possible to study the development of BSCs during intital ecosystem genesis on the artificial water catchment "Hühnerwasser" in the recultivation area of the lignite open-cast mining district. At this catchment substrate-dependent water availability defines the crust types. The mosaic-like pattern of the BSCs was associated with the distribution of fine-grained material. We defined three types BSC: (a) initial cyanobacterial and green algae crusts on the soil surface (BSC-I). (b) cyanobacterial and green algae crusts on the soil surface between sparse vegetation cover e. g. with Trifolium arvense (BSC-II). (c) BSCs with few mosses (BSC-III) between dense vegetation.

To compare the different crust types, chlorophyll amount as well as organic matter content were determined, and the structure of the crust was investigated using optical and scanning electron microscopy. In addition, we characterized the water regime of the crusts using water infiltration and repellency tests to determine the repellency indices by using the ethanol/water microinfiltrometer method (Hallett and Young, 1999).

Water infiltration was influenced by two factors: (i) the crust type, where infiltration rates were highest on almost bare substrate (BSC-I) and least when cyanobacteria and green algae formed a dense cover on the surface, and (ii) the texture. Compared to BSC-II, infiltration rates were elevated in BSC-III, pointing to decline of surface sealing when mosses penetrated the dense microphytic crust.

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