

EGU22-2354

<https://doi.org/10.5194/egusphere-egu22-2354>

EGU General Assembly 2022

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Spatial heterogeneity of buried and recent soils in a drift sand area in North-Eastern Germany

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In the North European Lowland, on the sandy deposits of the Weichselian glaciation, soils developed during periods of landscape stability are often conserved under windblown sand. However, small-scale changes of sediments and other soil forming factors can result in high spatial variation of soil properties in these landscapes; and relocation of soil material by geomorphic processes further increases the spatial heterogeneity of the soil landscape. These spatial variations in soil properties and conservation need to be considered in order to correctly decipher and interpret the buried soils as records of past environmental conditions.

In the forefield of the open-cast mine Cottbus-Nord, archaeological excavations in a dune and drift sand area revealed widespread buried soils of different characteristics. The densely spaced excavation trenches give exceptionally good insights into the pedosphere, allow for reconstructing the distribution of fossil and recent soils in a high spatial resolution, and offer good opportunities to improve the understanding of spatial and temporal patterns of soil formation. Remains of postpleistocene hunter-gatherer campsites were documented in archaeological excavations and found to be associated with a buried soil horizon.

We recorded the stratigraphy of soil profiles along more than 15 trenches within an area of about 20 ha, and additionally described the position of buried soils from GPR surveys and microdrone photogrammetry. In a recently opened, 455 m long trench, all characteristic soils and sediments of the study region could be observed and stratigraphically connected. Within this trench, four profiles were identified for further research. Each profile was classified and described according to WRB and German Guidelines for Soil Mapping; and was sampled and investigated through laboratory analyses including determination of organic matter, total carbon and nitrogen contents, soil colour identification, texture analysis, magnetic susceptibility measurement, metal content analysis using X-ray fluorescence analyzer and pH measurement. The compaction and cementation of soil horizons was assessed in situ with a pocket penetrometer.

Results show a small-scale mosaic of soils developed on fluvio-aeolian, limnic and aeolian sediments, high spatial variations in pedogenesis due to varying groundwater influence and

intensity of horizontal and vertical leachate transport, and high variations in the erosion or conservation of fossil soils. The soil and sediment stratigraphy reflects several phases of landscape development: i) the formation of a Late Pleistocene soil on fluvio-aeolian deposits, ii) a fossilization by aeolian sands, iii) a stability phase with intensive podsolization and peat formation, and iv) a land use-induced aeolian remobilization of the sands.