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Reconstructing spatial and temporal patterns of soil formation in an anthropogenic drift sand area in Northeastern Germany

Anna Schneider (1), Florian Hirsch (1), Thomas Raab (1), and Klaus-Peter Wechler (2)

(1) Geopedology and Landscape Development, BTU Cottbus-Senftenberg, Cottbus, Germany, (2) Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (BLDAM), Zossen, Germany

On the sandy deposits of the Weichselian glaciation, soils developed during periods of landscape stability are often conserved under windblown sand. The relatively diverse morphology of dune areas and the possibilities for dating the accumulation of windblown sediment offer good opportunities to improve the understanding of spatial and temporal patterns of soil formation. However, a mapping of the buried soils and surfaces is often limited to single outcrops. In the forefield of the open-cast mine Cottbus-Nord, archaeological excavations in an about 10 ha dune and drift sand area revealed widespread buried soils, mainly podzols, of different characteristics. Archaeological findings give evidence for the age of the buried surfaces. The densely spaced excavation trenches allow for reconstructing the distribution of fossil and recent soils in a high spatial resolution.

We created and analyzed digital models of the recent surface and the buried soils using a combination of methods: To characterize the recent ground surface, we used microdrone-based photogrammetry, LIDAR-based elevation data and GPS. To create a digital model of the palaeosurface and the distribution of fossil soils, we used soil and sedimentological mapping along excavation trenches, mapping of the elevation of excavated palaeosurfaces, and prospection of the fossil soils by Ground Penetrating Radar. Our studies reveal a high vertical and horizontal heterogeneity of soils, with varying thicknesses of eluvial and illuvial horizons and varying degrees of organic compound and sesquioxide accumulation. First results reflect several phases of landscape development: i) the formation of a Late Pleistocene soil on fluvio-eolian deposits, ii) a fossilization by eolian sands which underwent intensive podsolization, and iii) a land use-induced eolian remobilization of the sands. The soil characteristics' spatial distribution in relation to surface morphology indicates a high relevance of lateral leachate transport, even along very low gradients.