



Transformation of soil cover in post-mining area (the Moscow brown coal basin, Russia)

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In the Moscow brown coal basin the most intensive mining of sulfur coal was in Tula region (from 1850s to the beginning of 1990s), where about 180 coal mines had operated. This region is agricultural (up to 70% of the territory is ploughed); prevailing soils are Phaeozems (WRB 2014) (Leached Chernozems in Russian classification) which are one of the most fertile soils in Russia. The aim of the study is to evaluate the post-mining transformation of soil cover of this territory.

At mines sites the relief is noticeably transformed due to formation of spoil heaps, 40- 60 m in height, partially eroded; deluvial and proluvial dump tailings; as well as subsidences over the mined space, up to 6 m deep. Most of spoil heaps have not been remediated and evolve under the impact of exogenous natural factors. Acid mine drainage and pyritized technogenic waste material, coming from spoil heaps, cause changes in soil properties.

We investigated two key sites with total area of about 100 sq. km, west, south-west of Novomoskovsk, Tula region (38.3°E, 54°N). In field thirteen spoil heaps were described regarding their geomorphic characteristics, composition of the deposits and post-technogenic stage. The morphology of soil profiles in different types of landscapes was characterized. Chemical analysis of soil samples was performed (acid-base properties, content and composition of readily soluble salts, composition of exchangeable cations, content of organic carbon and oxidation-reduction properties).

Spoil heaps and dump tailings were mapped using ESRI Imagery. Areas of subsidences were delineated by calculating normalized difference water index (NDWI) using several Sentinel 2A images for different dates.

For one of the most representative spoil heap (37.98°E, 54°N) and its adjacent territory digital elevation model was built using field data. Soil properties of this key site were mapped at fine scale using GIS. The series of maps allowed to reveal peculiarities of soil cover specific for post mining areas.

Patterns of technogenic transformations of soils properties in post-coal mining area were described. A catenary sequence reflecting geochemical conjugations of technogenic, natural-technogenic and natural soils of the investigated territory was developed.