

Natural self-reclamation of soils and landscapes affected by agriculture and mining

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Processes of possible self-restoration of technogenically disturbed soils are studied in Central and Southern European Russia. Reclamation procedures are mainly not implemented in this vast region, and the natural soil restoration is supposed.

Heaps overlaying the former steppe and cropland landscapes are created in the course of rock waste stacking after preparative and cleaning mining works during the underground coal extraction. Approximately 1 500 heaps occupying over 8 000 ha were formed in the area of the Donets Coal Basin. Soils are destroyed under heaps, land subsidence occurs in coal mining areas and acid lakes are usually formed in these ground depressions. Spontaneous combustions happen often and can continue for decades. In order to prevent them, heap surfaces are in some cases levelled and filled with water, forming peculiar ponds. After 70 years of heaps existence and ca. 50 years after their ignition, soil formation is just in the early stages. Heap surface differs a lot in geochemical and mineralogical characteristics from those of surrounding steppe soils that suffered substantial changes at distances up to 1 km. Development of plant communities in areas near coal dumps and heaps is one of the indicators of landscape-geochemical changes. Formation of ruderal phytocenoses with 10–15 % of local flora, as well as invasive and introduced plants occurred under the complex impact of ecological conditions. Communities formed by them are distinguished by the structure simplicity, low species diversity, and plant growth anomalies.

Quarries and dumps are formed during underground and open-cast mining of ore deposits. During the last 50 years after abandoning mines in forest areas, the 30 m deep quarries have filled with the creep material less for 0.5 m, and sediments from water streams have added 1–3 cm. Thickness of argillaceous layers does not exceed 1–2 cm at small rock chips of the dumps that measures up to 70 km in length. The dumps are partially covered with woody vegetation. As compared to the zonal vegetation, communities of abandoned mines are characterised by 4–5 times lower biomass, structure simplicity, medium or low species diversity, slow growth and reduced vitality of forest-forming species. With a large volume of stripping works, dump areas amount to the first hectares, and they are almost bare even 50 years later.

Soils of vineyards abandoned 25 years ago are different from soils of previously existed forest landscapes by heightened average concentrations of Ba, Cr, Cu, and Mo and decreased levels of Li and Ga. Accumulation is up to 42 t/km² and takeout is up to 6 t/km². Soils of tea plantations are characterised by enriched contents of Mn and Ti (hundreds of t/km²) and decreased levels of Ba, Li, Pb, Be, Yb, and Ge (up to 54 t/km²), as compared to soils of forest landscapes.

Thus, without implementation of special reclamation measures after deposit mining and agronomic activities, self-restoration does not take place even in 50 years. Estimates allow us to assume that natural reclamation will occur in hundreds of years.

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