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STRESZCZENIE ROZPRAWY DOKTORSKIEJ W JĘZYKU ANGIELSKIM

Kształtowanie procesów pedogenicznych w glebach technogenicznych utworzonych na zwałowiskach kopalni wapieni z uwzględnieniem wybranych czynników

Development of pedogenetic processes in technogenic soils formed on limestone mine spoil heaps under the influence of selected factors

Open-pit mining, including the extraction of carbonate raw materials, contributes significantly to the degradation of the natural environment by altering land surface morphology (excavations and spoil heaps) and, most notably, by destroying the soil cover. An effective reclamation process, including soil reconstruction, must be implemented to mitigate the negative impacts of such activities. The direction of reclamation and the intended land use should be tailored to prevailing environmental and technical conditions and must be economically justified. Post-mining excavations from carbonate raw material extraction present particular challenges for reclamation due to, among others, their high content of rock debris and calcium carbonate, low levels of organic matter and macronutrients, and alkaline soil reaction.

This study focused on technogenic soils formed during the reclamation of spoil heaps from limestone mining at the "Górażdże" quarry, targeting forest development. The research included 16 reclaimed experimental plots, two of which exhibited spontaneous vegetation succession. The plots varied in tree stand type (black alder or Scots pine) and the time since the last reclamation treatment (ranging from 1 to 35 years). For comparison, reference plots were established on nearby forest soils (three soil profiles) and on one profile of arable land.

The study aimed to assess how the type of spoil material used (clayey or sandy) and the tree stand species influence soil formation processes. An additional goal was to identify changes in the properties of technogenic soils on carbonate mining spoil heaps over time. Parameters indicating soil-forming processes and soil quality were determined in accordance with established standards and soil science methodologies.

The results showed that using clayey spoil material in reclamation improved soil properties, particularly sorption capacity, organic carbon and nitrogen content, and macronutrient availability. It also affected soil pH, shifting it towards neutral or alkaline levels. The method of distributing spoil material on heap surfaces resulted in varied properties within newly forming soils, both at the surface and within the profile. Black alder stands had a more beneficial effect on the soil properties compared to Scots pine, primarily due to greater accumulation of carbon and nitrogen in the surface layers. Over time, soil formation processes progressed, as evidenced by thicker humus horizons and increased levels of organic carbon and nitrogen.

Additionally, the study proposed a Soil Quality Index for Post-Carbonate Mining Sites (WGP_{Ca}) to assess reclamation effectiveness and guide management practices for similar post-mining landscapes.

Keywords: open-pit mining, carbonate raw materials, reclamation, technogenic soils.