Geophysical Research Abstracts, Vol. 9, 01486, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-01486

Structures and processes in initial soil genesis at lignite mining spoils

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Opencast lignite mining results in severe multiple disturbances of ecosystem functions on large scales up to the landscape level. In Germany, as the world´s largest lignite producer, large regions are heavily affected by these mining activities. In the Lusatian lignite mining district (E-Germany) alone, an area of 80.000 ha is characterized by overburden dumps, tailings and mining lakes due to intensive lignite mining. On 60% of this area forests have been restored, mainly pine and oak stands (Hüttl & Weber 2003).

The young soils of these afforested sites are dominated by a mixture of overburden substrates containing various amounts of lignite and pyrite. Typically a large small-scale heterogeneity is found in chemical and physical soil properties caused by both the substrate heterogeneity and the intensive amelioration measures necessary to mitigate the initially phytotoxic site conditions prior to planting.

Characteristic features of these developing soils are a sandy texture, poor water and nutrient storage capacity, high acidity and salinity due to pyrite oxidation and mineral weathering, secondary mineral formation, and a high content of geogenic organic matter in various forms and spatial distribution.

We studied the specific soil chemical structures and processes in pedogenesis along a chronosequence of mine sites as well as its properties and effects on element turnover at various scales using intensive field measurements, small-scale monolith sampling, and soil column experiments (Schaaf 2001, Schaaf 2003).

Heterogeneity in these soils is mainly introduced by the content and distribution of geogenic organic matter and its related physico-chemical properties affecting water

and element transport in the ecosystem, element transformation and release processes, nutrient cycling, and soil development. Thus, these specific features have to be considered for the prognosis of soil quality, nutritional status, and long-term stability of the restored mine sites (Schaaf & Hüttl 2006).

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