



Soil of the Year 2019 – Mine dump soil (Dump Regosol)



Authors:

. Heinkele, D. Knoche (Forschungsinstitut für Bergbaufolgelandschaften e.V.), H. Andreae, F. Jacob (Staatsbetrieb Sachsenforst), A. Bräunig, R. Hoffmann (LfULG Sachsen) in cooperation with the curatorship Soil of the Year. The Soil of the Year 2019 is under the auspices of Minister of state Thomas Schmidt, MdL

Translation: E. Eberhardt, BGR



Sandy Regosol under forest



Dump loamy sand, reclaimed for agricultural use

Dump Regosols are young soils that have developed over some tens of years on post-mining reclaimed land. They evolve from dumped overburden, an unconsolidated material that is non-calcareous or poor in lime. The German soil classification assigns them to the classes *Terrestrial raw soils* and here to the *Regosols*) and *Ah/C soils*. The international soil classification *WRB* allocates them also to the *Regosols*, or, if they are very sandy, to the *Arenosols*.

Dump Regosols follow the mining operations

Dump Regosols develop where man extracts raw materials, in particular lignite, and fundamentally reshapes the original landscape. Huge bucket-wheel excavators completely remove the overburden that lies

above the raw materials. The original soil gets lost in the process. The overburden backfills the open mine workings that remain after the raw material extraction. After levelling out or bulldozing and a re-colonisation by plants, an initial soil development starts at the surface of the dump. New soils form – the overburden dump soils.



Excavation of plantable top layer



Unlevelled dump area

Overburden dump substrates affect soil properties

The central pedogenic process of Dump Regosols is the accumulation of organic matter in the topsoil. Below the humic topsoil, which is – depending on the age of the soil – between 2 and 30 cm thick, lies the practically unaltered overburden substrate. Its properties determine the characteristics of the less developed dump soils.

Sand, coal and sulphur: Nutrient poor – dry – acidic

Sandy Dump Regosols often display a low nutrient and water storage capacity, but are well penetrable for roots and a good water conductivity. Some dumping techniques cause higher shares of coaly constituents. These improve indeed the nutrient and water storage characteristics, but often hold considerable quantities of sulphur-containing minerals (Pyrite and Marcasite). When these oxidise, iron oxide rich acid sulphate dump soils with pH values well under 3 (like vinegar) develop within a short period of time. To reclaim them, an intense amelioration with a high lime input and a specific fertilisation strategy. Otherwise, these soils remain unpopulated by plants for decades.



Dump coaly sand: un-amliorated dump



Regosol under forest

Boulder clay, sandy loam, loess: Nutrient rich – water storage – frequently dense (compacted)

Dumped loamy sands, boulder clays and loess (loam) can predominantly be found in the central German and Rhenish, but rarely in the Lusatian coal mining districts. They exhibit a medium to high nutrient availability and a sufficient capacity for storing water.

A specific crop-rotation for rehabilitation with deep-rooting, nitrogen fixing plants that enhance the soil structure foster an intense and deep-reaching humus accumulation during the initial years.

Improper dumping, levelling or treatment of the soil may rapidly result in a compacted layer below the plough layer (a plough pan). It impedes root growth and may cause undesirable water stagnation. During rehabilitation, adverse soil compaction should be avoided or remediated, perhaps by depth loosening with a heavy grubber combined with multi-annual cultivation of deep-rooting plant species.



Dump loamy sand, reclaimed for agricultural use



Lucerne roots affected by adverse soil compaction

Distribution

Larger areas with Dump Regosols can be found in the active lignite opencast mining districts of Lusatia (1), in Central Germany (2) and in the Rhineland (3). In the abandoned smaller mining districts near Helmstedt (4), in central Hesse (5) and Upper Palatinate (6), Dump Regosols occur in places only. In relation to Germany's total area, Dump Regosols stretch over small areas. In the federal states of Saxony, Saxony-Anhalt and Brandenburg, they regionally cover considerable areas, however, and characterise the landscape. They exemplify the responsibility for the sustainable reclamation of destroyed soil-landscapes.

Dump Regosols: can be used in many ways

Mine Dump Soils

The chemical and physical properties of the dumped substrates determine the possibilities of land use of the newly developed soils.

Agricultural use

On reclaimed land with loamy and nutrient rich dumped substrates, a permanent agricultural reuse is possible. In the central German as well as in the Rhenish lignite-mining districts, agricultural use of the reclaimed areas is typical.

Silvicultural use

Sandy Dump Regosols with a lower availability of water and nutrients are to the most part silviculturally used when appropriately ameliorated. In Lusatia dominates the forestal reclamation with the undemanding scots pine, accompanied by several broad-leaf species, in particular sessile and pedunculate oak, silver birch, small-leaved lime or red oak.



Agricultural land use after recultivation



Soil use under forest after recultivation

Open land and nature conservation

Dump areas with a mosaic of various substrates on a small scale are slightly ameliorated only, if at all. When such areas with their high heterogeneity of ecological conditions remain un-ameliorated, they hold a multitude of highly different ecological niches for plant and animal species, which are very rare in our intensively used „cultural landscape“. They can be very valuable for the protection of these species and biotopes.



Open areas for natural conservation

It's worth the effort: New soils in new landscapes

The restoration of functional ecosystems on the land the opencast mining left behind is a true Herculean task. With staying power, the due expertise and the commitment of all involved people, destroyed fields become new landscapes with multifunctional soils that can be used in many ways. Only re-establishing the original soils is certainly a matter for thousands of years to come – merely and simply geological periods of time.



Landscape before restoration



Landscape after restoration

Further information provided by

Website Soil of the Year / www.boden-des-jahres.de

Deutsche Bodenkundliche Gesellschaft / www.dbges.de

Bundesverband Boden / www.bvboden.de

Ingenieurtechnischer Verband für Altlastenmanagement und Flächenrecycling e.V. / www.itv-altlasten.de

Staatsbetrieb Sachsenforst (SBS)

E-Mail: henning.andreae@smul.sachsen.de

Sächsisches Landesamt für Umwelt, Landwirtschaft und Geologie (LfULG)

E-Mail: arnd.braeunig@smul.sachsen.de

Forschungsinstitut für Bergbaufolgelandschaften e.V. (FIB)

E-Mail: t.heinkele@fib-ev.de

Information materials

Umweltbundesamt

www.umweltbundesamt.de/publikationen

Compact Discs informing about all Soils of the Year 2005 until 2019

www.boden-des-Jahres.de

Pictures

Forschungsinstitut für Bergbaufolgelandschaften e.V.; Lausitzer und Mitteldeutsche Bergbau-Verwaltungsgesellschaft mbH; Büro für Bodenwissenschaft, Freiberg; Büro für Bodenkunde, Voigtsdorf; Sächsisches Landesamt für Umwelt, Landwirtschaft und Geologie

Landscape picture on the title: Raphael Benning

Impressum

Common campaign of the Freistaat Sachsen and the Kuratorium Boden des Jahres (Deutsche Bodenkundliche Gesellschaft, Bundesverband Boden, Ingenieurtechnischer Verband für Altlastenmanagement und Flächenrecycling e.V.) and the Umweltbundesamt. 2019