



Initial substrate characteristics and soil solution composition in the artificial catchment 'Chicken Creek'

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To combine process-oriented research on initial development of ecosystems with interactions and co-development of spatial patterns and structures the Transregional Collaborative Research Centre (SFB/TRR) 38 (www.tu-cottbus.de/sfb_trr) was established as an initiative of three universities (BTU Cottbus, TU Munich and ETH Zurich). The objective of the SFB/TRR 38 is to enhance our understanding of structure genesis in ecosystems and of process dynamics as well as their interactions during the initial development phase. The artificial catchment was constructed in the mining area of Lusatia/Germany as the main research site (Gerwin et al. 2009). With an area of about 6 ha, this catchment 'Chicken Creek' is to our knowledge the largest artificial catchment worldwide. It was constructed as a 2-4 m layer of post-glacial sandy to loamy sediments overlying a 1-2 m layer of Tertiary clay that forms a shallow pan and seals the whole catchment at the base. No further measures of restoration like planting, amelioration or fertilization were carried out to allow natural succession and undisturbed development. Initial soil conditions were characterized by intensive grid sampling throughout the catchment. There is textural difference between the western and the eastern part of the catchment due to the fact that the substrates were dumped in two different periods during the construction process. In the NE part of the catchment pure sands dominate whereas the SW part has more loamy sands. Due to the carbonate content the pH values are weakly alkaline or neutral. The low contents in organic carbon, pedogenic oxides and clay mineralogy underline the initial state of the soil.

Soil solution is sampled at four soil pits that were excavated down to the saturated layer in 2-2.5 m depth by hand and stabilized with a lining of PE rings with a diameter of 1m. From these pits boron silicate glass suction plates were installed into the soil in 2-3 depths. Soil solution is collected using a permanent pressure head of -10 kPa and sampled biweekly.

Soil solution composition varies considerably between the four soil pits during the observation period. Compared to these spatial variations, differences in soil depth and over time are less pronounced. Main components of all sampled soil solutions are Ca²⁺, Mg²⁺, HCO₃⁻ and SO₄²⁻. Due to the carbonate content of the substrates, mean pH values vary between 7.0 and 8.0 in all samples. No correlations were found between soil solution compositions and soil parameters of the surrounding grid samples. Compared to the low organic carbon and total sulfur contents of the parent material, the concentrations of sulfate and DOC are surprisingly high.

During summer drought periods pale whitish precipitations were frequently observed at the vertical walls of erosions gullies. Microscopy revealed that these precipitations form a very thin crust composed of very small crystal grains. Further analysis using SEM and EDX mapping showed that the particles are composed of Ca and S indicating gypsum or anhydrite. Similar findings in Chernozems of Central Germany. were interpreted as gypsum formation due to former high sulphur deposition together with low precipitation and leaching (Dultz and Kühn 2005).

References

- Dultz, S. and Kühn, P., 2005: Occurrence, formation, and micromorphology of gypsum in soils from the Central-German Chernozem region. *Geoderma* 129, 230-250.
- Gerwin, W., Schaaf, W., Biemelt, D., Fischer, A., Winter, S., Hüttl, R.F., 2009: The artificial catchment "Chicken Creek" (Lusatia, Germany) - a landscape laboratory for interdisciplinary studies of initial ecosystem development. *Ecological Engineering* 35, 1786-1796.