Modeling of soil degradation in the Czech critical zone observatories

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Three small catchments situated 5-7 km apart, with similar forest cover (Norway spruce), but underlain by contrasting bedrocks served as critical zone observatories (CZO). Sites are situated in the geochemically diverse Slavkov Forest [1] close to power plants with large S emissions in 1950s - mid 1990s. The MAGIC model [2] was used to simulate soil and water chemistry. Model parametrization at Lysina (LYS, area 27 ha, podzol on leucogranite) and Pluhuv Bor (PLB, 22 ha, stagnosol on serpentinite) was based on published data [3]. Parametrization at Na Zelenem (NAZ, 55 ha, cambisol on amphibolite) was based on recent sampling [4]. Simulated soil base saturation (BS) declined from 20% to 6% at LYS, from 56% to 31% at NAZ, and from 94% to 88% at PLB (Fig. 1). Contrasting soil and drainage water compositions were generated mainly by differences in chemical weathering rates of divalent base cations, Ca and Mg (0.4 keq/ha/a at LYS, 1.5 keq/ha/a at NAZ, and 2.4 keq/ha/a at PLB).

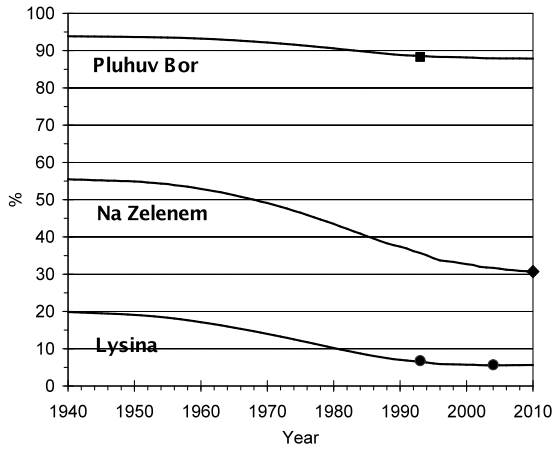

Figure 1: Simulated (lines) and measured (dots) soil base saturation at three Czech CZO in the Slavkov Forest.

[1] Kram (2010) *Geochim. Cosmochim. Acta.* **74**, A537. [2] Cosby *et al.* (2001) *Hydrol. Earth System Sci.* **5**, 499–517. [3] Hruska & Kram (2003) *Hydrol. Earth System Sci.* **7**, 525–539. [4] Rousseva *et al.* (2010) Datasets on soil physical, geochemical & biological properties. SoilTrEC Report.

Plant-microbe interactions in Cd-contaminated soils - Do Fe(III)-reducing bacteria influence the accumulation of Cd in the metal-hyperaccumulating plant *Arabidosis halleri*?

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Soils worldwide have increasingly been contaminated with industrial waste metals, such as cadmium, which may subsequently enter the food chain through plants. These toxic metals can have dramatic effects on human and environmental health. Therefore, there is a need for the development and application of new techniques to efficiently remediate contaminated soils. In the present study, we combined phytoremediation and (microbially) enhanced natural attenuation to determine whether a more time- and cost-efficient removal of cadmium from contaminated sites can be achieved. In plant-microbe-soil microcosms, geochemical and microbial parameters are determined to trace the microbial release of cadmium from Cd-bearing Fe (III) minerals by the natural microbial community of the soil or by an isolated Cd-tolerant Fe (III)-reducing bacterium. Additionally, cadmium uptake and accumulation by the metallophyte Cd hyperaccumulator plant *Arabidopsis halleri* in the presence of these bacteria is quantified. Cadmium is made phytoavailable to the plant by the stimulation of naturally occurring Fe (III)-reducing bacteria which release cadmium from Fe (III) (hydr)oxides through reductive dissolution. Subsequently, the aqueous cadmium is actively taken up by the plant *A. halleri* and accumulated in the above ground tissue. By harvesting the plant regularly, an efficient removal of cadmium from contaminated sites may be achieved.