



## In-situ imaging of iron and manganese mobilisation in forest floor layers

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Mobility of iron and manganese in forest soils is controlled by the redox state, the overall pH-value and the concentration of complexing organic acids. The solubility of Mn and Fe oxides is an indicator of reductive activity processes and furthermore strongly connected to the availability of phosphorus for plants. Yet the strong small-scale heterogeneity of forest floor makes the spatial and temporal patterns of stable and soluble iron and manganese forms challenging to quantify. 20 etched 10x15cm glass slabs were coated with either an iron or manganese oxide (goethite and birnessite, respectively). Slabs were vertically inserted in the forest floor with close contact between the oxide coating and the soil, and left for one growing season in a spruce-beech forest. The forest floor was a moder circa 12 cm thick, and the soil was a Dystric Cambisol. In fine humus-rich Ohf and Obh horizons, the rate of mobilisation of goethite and birnessite was generally > 50 % of the area, with more birnessite lost than goethite. Most mobilisation was found along the finest roots in the organic horizons. For goethite, mobilisation underwent a gradual transition from high mobility in organic horizons to minimal mobility in mineral soil. For birnessite in contrast, there was barely any mobilisation in mineral soil. The substantial mobilisation in organic horizons primarily along fine roots suggest that complexation by exuded organic acids is a dominant process in iron and manganese mobilisation. Yet deeper in the forest floor and mineral soil, reductive processes due to aeration deficiencies likely play the major role in iron and manganese mobility. Since the complexation of iron by organic acids can enhance phosphorus availability, we conclude that the spatial pattern of iron mobilisation reflects the root- and mycorrhiza-driven P-mobilisation.