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Phosphorus mobilization in acid forest soils as affected by interactions of water regime, fertilization and growth of beech

Lukas Gerhard, Heike Puhlmann, Margret Vogt, and Jörg Luster
Forest Research Institute Baden-Württemberg, Soil and Environment, Germany (lukas.gerhard@forst.bwl.de)

In a changing climate, prolonged periods of drought alternating with more intense rain events are thought to occur more often. The resulting drying and rewetting (DRW) of soils can mobilize Phosphorus (P) as an essential nutrient for sustainable forest growth. Anthropogenic input of Nitrogen (N) is another factor possibly affecting the leaching of P from forest soils, namely by increasing P fluxes, an effect, however, that may decrease with soil depth. Plant-unavailable P sorbed to subsoil aggregates may partly become available through desorption under anaerobic conditions during wet periods. In this project, the P mobilization potential responding to different water regimes, nitrogen input and combinations of the two is investigated. Another aspect is the effect of changing soil water status and varying redox conditions on depletion and recharge of P-pools within soil aggregates.

A DRW experiment is conducted with 90 mesocosms each containing a young beech tree growing in undisturbed native soil from three forest sites representing a gradient of available soil P. Sample subsets are dried to a defined soil water potential and re-wetted at different rates.
A second experiment comprises percolation tests on 48 undisturbed aggregated subsoil columns. Subsets are subjected to alternating aggregate-P discharge/recharge phases by applying different extractants and varying waiting periods.

The DRW experiment is used to test the hypotheses that P leaching and mobilization are influenced by soil water status, and how increased N supply affects P mobilization under DRW. In the percolation experiment, we want to test the hypothesis that the intra-aggregate P-pool is connected to aggregate surfaces and macropore water by 1st order diffusion processes.