K-minerals: the backbone of acid neutralization in Dutch nature reserves

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Abstract

Increased acid deposition since the industrial revolution has induced severe soil degradation in Dutch nature reserves. Consequently, plant and animal species have disappeared or are declining at an alarming rate, being replaced by a few species best adapted to low soil pH and high ammonium and aluminium concentrations (Vogels et al., *In press*, Bobbink & Hettelingh 2011). Until recently, soil pH and base saturation were the primary parameters to monitor the effect of acidification on ecological quality. To mitigate effects of acidification, limestone has been applied to increase pH and base saturation (Dorland et al., 2004). However, for several reasons, liming is not always favourable. In inherently carbonate free sandy soils it may lead to undesired changes in soil ecological functioning (Frostegård et al., 1993). We expect this can be prevented by using silicate minerals instead as they more closely resemble the original soil minerals.

In order to understand mineral weathering in relation to soil chemistry, detailed weathering studies were conducted in soils of varying age. Soil cores were taken and weathering profiles were constructed using portable XRF data. Detailed mineralogical analysis of A/E-horizon and C-horizon was performed with QEMSCAN. Mineral depletion was both determined with the classical depletion method (Olsson and Melkerud, 2000) and a novel K/Ti based method.

Results indicate that soil weathering rates during the last century have increased 50-100 times. In some cases soil mineral stocks are significantly reduced, with K-bearing minerals accounting for 40-65% of this loss. Last century the weathering rates of K-minerals even seem to have increased relative to Ca/Mg-minerals.

We believe that anthropogenically enhanced soil mineral weathering is and has been greatly adding to the current acidification problem. Soil mineral restoration is imperative for complete ecological recovery and K-minerals play a key role in this.

References

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