

Highlights of Analytical Chemistry in Switzerland

Monitoring of Water Chemistry in Forest Soils: An Indicator for Acidification

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Keywords: Acid deposition · Acidification · Lysimetry · Recovery · Soil solution

Acid atmospheric deposition can affect the chemistry of soils and drainage waters in forest ecosystems and accelerate the acidification of soils. In acidic soils, the input of acidifying compounds increases the mobility of aluminum that can reach toxic levels for sensitive plant species. In addition, leaching losses of nutrients such as Ca, Mg and K may increase as a result of acidic deposition. These cations are important for tree nutrition and a depletion can affect both biomass production and, by an imbalanced nutrition, tree health and sensitivity to pests.

The soil water chemistry in a chestnut forest at Copera near Monte Ceneri in Ticino has been monitored since 1987 to measure the soil response to atmospheric acid deposition. This area, with its mainly acidic bedrock, is very sensitive because the soil is poorly buffered. It has received high loads of acidifying compounds due to local and long-range emissions from the industrial Po Valley in Italy. Acid deposition declined through the 1980s and 1990s, mainly because of the reduction of SO₂ emissions following air pollution abatements. This raised the question whether the forest soil has recov-

ered since then. The ratio of base nutrient cations (BC = Ca²⁺ + Mg²⁺ + K⁺) to dissolved aluminum (BC/Al) in the soil solution was used to assess soil acidification and the associated ecological risks.

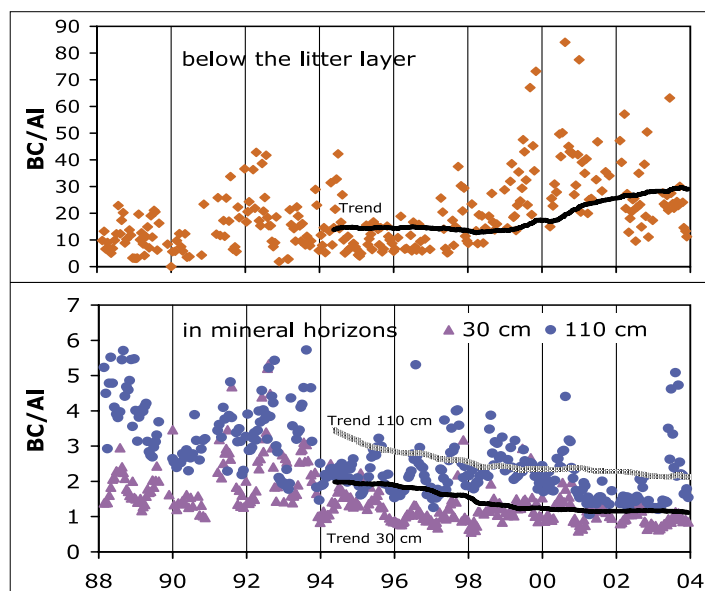
Water samples were collected fortnightly with tension lysimeters. The main chemical characteristics of the soil solutions were measured routinely: pH, electric conductivity, dissolved organic carbon, concentrations of major cations and anions. A significant decrease in BC/Al ratios has been observed since 1987, indicating a rapid soil acidification. However, initial signs of recovery were detected recently below the litter layer. In the mineral horizons, the ratios have stabilized since the late 1990s, suggesting that acidification has slowed down.

Reference

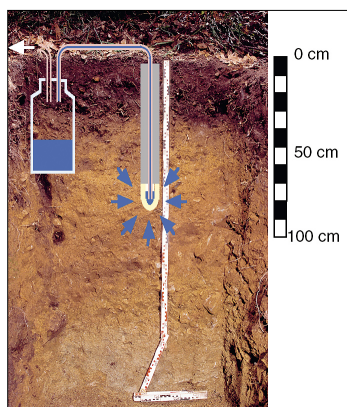
E. Graf Pannatier, J. Luster, S. Zimmermann, P. Blaser, *Environ. Sci. Technol.* **2005**, *39*, 7761.



Chestnut forest stand at Copera



BC/Al ratios in the soil solution below the litter layer, in the (AE) eluvial horizon (30 cm) and in the B_(s)C transition horizon to bedrock (110 cm). Thick lines are moving averages with a time window of six years



Tension lysimeter in soil profile



Installation of a lysimeter

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