TECHNISCHE UNIVERSITÄT DRESDEN

Fakultät Umweltwissenschaften – Institut für Bodenkunde und Standortslehre

Professur für Standortslehre und Pflanzenernährung

Topic for master thesis

Identification of sources for sulfur (S) supply in forest ecosystems

Sulfate deposition with acid rain was a serious problem for forest ecosystems in North and Central Europe during the 1970-90s causing severe impacts on forest ecosystems. In the following decades, it was assumed that S availability in European forests is sufficient and, thus, not a problem. Nevertheless, recent reports of clearly decreased S stocks in forest soils and of reduced S foliar contents point to the potential of arising S deficiencies in European forests. Until the early/mid 1990s, terrestrial systems retained sulfate, but shifted towards net release since the late 1990s, possibly due to mobilization of legacy S pools of former deposited atmospheric S. The national forest soil inventory in Germany (BZE) indicated a considerable decrease of S stocks in the forest floor (O-layer) and of sulfate in soil solution between the first inventory in the early 1990s and the second inventory in 2006/08. Consequently, the S nutritional status in forest ecosystems is increasingly relying on internal S cycling (from mineralization) and S supply from mineral sources. An approach to gain insights both in tree-internal and ecosystem-level S cycling is to measure stable S isotopes in the different compartments, because the relative abundance of certain S isotopes (^{34}S) can be related to specific S sources for forest nutrition.

The main objective of the proposed master thesis, therefore is to differentiate sources for S supply in different forest ecosystems by determining the abundance of the stable ^{34}S isotope ($\delta^{34}S$) in trees and soils. Especially for sites with former very high atmospheric S deposition, it is unclear how S cycling and tree nutrition may have changed within the last decades. In the master thesis, such sites (Erzgebirge) will be analyzed in comparison to a low-input site (Schwarzwald). The analysis of S isotopes be conducted using Isotope Ratio Mass Spectrometer (IRMS MAT 253, Thermo Fisher Scientific) in cooperation with the Institute of Groundwater Management at TU Dresden.

Literature:

Gebauer G, Giesemann A, Schulze E-D, Jäger H-J (1994) Isotope ratios and concentrations of sulfur and nitrogen in needles and soils of Picea abies stands as influenced by atmospheric deposition of sulfur and nitrogen compounds. Plant Soil 164:267–281. doi: 10.1007/BF00010079

Krouse HR, Case JW (1981) Sulphur isotope ratios in water, air, soil and vegetation near teepee creek gas plant, Alberta. Water Air Soil Pollut 15:11–28. doi: 10.1007/BF00285530

Mitchell MJ, Mayer B, Bailey SW, et al (2001) Use of stable isotope ratios for evaluating sulfur sources and losses at the Hubbard Brook experimental forest. Water Air Soil Pollut 130:75–86. doi: 10.1023/A:1012295301541

Wellbrock N, Bolte A, Flessa H (Eds) (2016) Dynamik und räumliche Muster forstlicher Standorte in Deutschland: Ergebnisse der Bodenzustandserhebung im Wald 2006 bis 2008. Johann Heinrich von Thünen Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries

Bertreuer: Dr. Dorit Julich, Prof. Karl-Heinz Feger

Kontakt: Dr. Dorit Julich, dorit.julich@tu-dresden.de, Tel.: 0351-463 31390

Postadresse (Briefe)
Postfach 1117, 01735 Tharandt

Postadresse (Pakete u.ä.)
Pienner Straße 19, 01737 Tharandt

Besucheradresse
Sekretariat: Pienner Straße 19, 2. Etage, Zi. 2.29

Internet
http://boku.forst.tu-dresden.de/