TECHNISCHE UNIVERSITÄT DRESDEN

Fakultät Umweltwissenschaften, Fachrichtung Forstwissenschaften

Institut für Bodenkunde und Standortslehre, Professur für Bodenressourcen und Landnutzung

Technische Universität Dresden, 01062 Dresden

Topic for BSc / MSc Thesis

Bacterial versus plant effect on soil aggregation

Soil structure, expressed as aggregation and aggregate stability, is important for a wide range of soil functions, including soil aeration and erosion control. It is well known that plants have a positive effect on soil aggregation and aggregate stability via the organic matter input and the enmeshing of soil material by their roots (Blankinship et al., 2016). A less well studied effect on soil aggregation are the extracellular polymeric substances (EPS) excreted by soil bacteria. The effects of EPS on aggregate stability are twofold, as it adsorbs to mineral surfaces and forms bridges between mineral surfaces (Mikutta et al., 2011).

To understand the processes, the different effects on soil aggregation are examined under controlled conditions in a greenhouse experiment. Together with our project partners at the Julius Kühn Institute (Braunschweig) we are currently setting-up such a greenhouse experiment. The grass *Stipa tenacissima* and shrub *Anthyllis cytisoides* will be planted in separate pots. The biofilm producing bacteria *Bacillus subtilis* will be inoculated in half of the planted samples plus in similar pots without the plants. Samples will be taken at different times since planting to study the influence of the developing rooting system on soil aggregation and aggregate stability.

The thesis will focus on the development of soil aggregates over time under the different treatments. Depending on the size of the thesis, and your interests, the thesis can be narrowed down to a) The effect of plants on aggregation b) Bacterial effect on aggregation c) Combined effect only without the development over time. During your thesis you will get the opportunity to obtain experience with a range of laboratory test – from physical aggregate stability tests to the quantification of microbial products in soil extracts.

Figure 1 *Anthyllis cytisoides* (left) and *Stipa tenacissima* (right) growing under natural semi-arid conditions.

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
boku.forst.tu-dresden.de/

Interesting papers:

Blankinship, J. C., Fonte, S. J., Six, J., & Schimel, J. P. (2016). Plant versus microbial controls on soil aggregate stability in a seasonally dry ecosystem. *Geoderma*, 272, 39-50.

Mikutta, R., Zang, U., Chorover, J., Haumaier, L., & Kalbitz, K. (2011). Stabilization of extracellular polymeric substances (Bacillus subtilis) by adsorption to and coprecipitation with Al forms. *Geochimica et Cosmochimica Acta*, 75(11), 3135-3154.

Tang, J., Mo, Y., Zhang, J., & Zhang, R. (2011). Influence of biological aggregating agents associated with microbial population on soil aggregate stability. *Applied Soil Ecology*, 47(3), 153-159.

Supervisor: Jeroen Zethof, Prof. Karsten Kalbitz

Contact: Jeroen Zethof

jeroen.zethof@tu-dresden.de

Tel.: (+49) 35203 38- 31391

Prof. Dr. Karsten Kalbitz

Karsten.kalbitz@tu-dresden.de

Tel. (+49) 351 463 31379