INSTITUTE OF SOIL SCIENCE AND SITE ECOLOGY
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Title: «The Current Beneath: Leveraging Electrical Resistivity Tomography to Understand Soil Moisture Dynamics in a near-natural beech forest»

Background and motivation:

Soil moisture dynamics and its relationship with geophysical properties is fundamental to understanding ecosystem processes and environmental sustainability. In the context of near-natural beech forests situated in a terminal moraine landscape in the NW Saxony lowlands, the interaction between soil moisture and soil electrical properties presents an intriguing avenue for research. This proposal outlines a comprehensive MSc research study aiming at elucidating the underlying mechanisms and ecological implications.

Objectives:

1. To analyse the electrical resistivity of soil in a near-natural beech forest on a terminal moraine using electrical resistivity imaging (ERI) techniques.

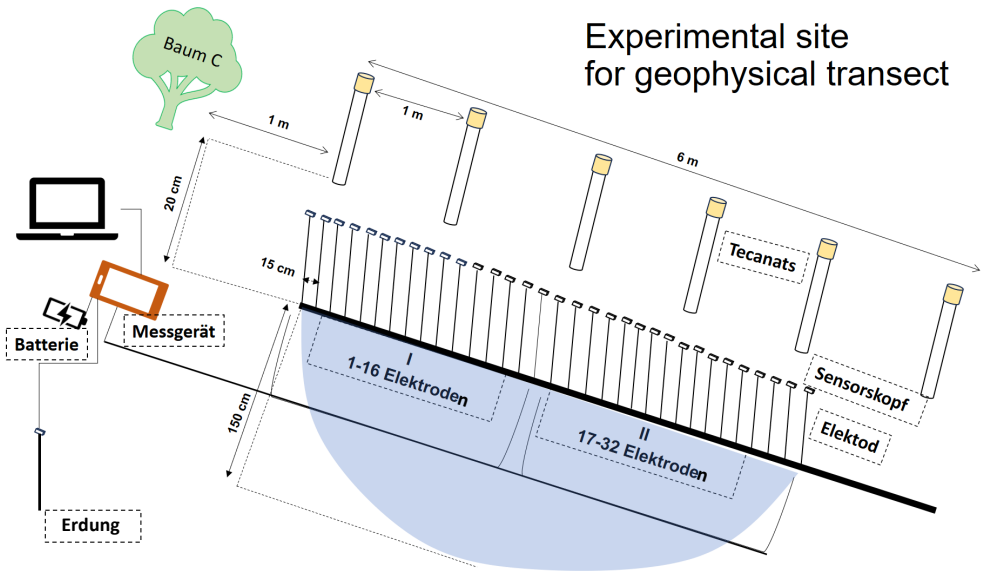
2. To quantify soil moisture dynamics from locations near tree stems to those distant from stems within the forest stand.

3. To investigate the correlation between soil moisture content and soil electrical resistivity in the study area.

4. To analyse the connection between coarse root biomass as measured by ERI techniques and soil moisture dynamics.

Methodology:

1. Electrical Resistivity Analysis: Conduct electrical resistivity imaging (ERI) surveys across the study area to map variations in subsurface resistivity. ERI data will be collected using a resistivity meter and electrodes positioned at regular intervals. Data analysis will involve inversion techniques to generate resistivity profiles and identify spatial patterns.



Experimental design of the electrical resistivity tomography monitoring transect

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2. Soil Moisture Measurement: Utilize soil moisture sensors installed at multiple depths and distances from tree stems to monitor temporal variations in soil moisture content. Measurements will be taken at regular intervals to capture seasonal and biweekly fluctuations.

3. Correlation Analysis: Assess the relationship between soil moisture and soil resistivity using statistical methods such as Pearson correlation coefficient analysis. Spatial and temporal variations in both parameters will be compared to identify potential correlations.

The MSc research is embedded in the ongoing joint research project BENEATH with contributions from various units of the TU Dresden departments of Forest Sciences. The candidate will be affiliated with the Institute of Soil Science and Site Ecology. The geophysical component will be partly supervised by a partner at Göttingen University (Department of Physical Geography).

Expected Outcomes:

1. A detailed characterization of electrical properties in the shallow subsurface of a near-natural beech forest on terminal moraine.

2. Insights into the spatial and temporal dynamics of soil moisture distribution across the study area.

3. Identification of potential correlations between soil moisture content and soil electrical properties, elucidating underlying ecohydrological processes.

Significance and Implications:

This study will contribute to our understanding of the complex interplay between soil moisture dynamics and geoelectrical properties in near-natural forest ecosystems. The findings will have implications for forest management practices, hydrological modelling, and ecosystem conservation efforts.