EGU2020-9107
https://doi.org/10.5194/egusphere-egu2020-9107
EGU General Assembly 2020


# Usage of visual and near-infrared spectroscopy to predict soil properties in forest stands

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There is a high demand for information about soil conditions in forests stands as it is crucial to ensure sustainable management, to maintain ecosystem services, to preserve timber production and establish proper pest management. Nowadays, the main drivers for changes in soil conditions are element input, forest conversion, subsoil liming and changing climate. These drivers influence nutrients and water availability and are challenging current site mapping methods. However, for impact assessment high-resolution and up-to-date information is needed. As laboratory analysis is time consuming and expensive, alternative approaches are preferred.

The project DIGI-Humus uses methods of reflectance spectroscopy in the visual and near-infrared-region of the electromagnetic spectrum for indirect measurement and prediction of physical and chemical soil properties in forest stands. For this purpose, spectral data were collected under laboratory conditions to build a database of forest soils. We used retained samples from Saxony soil survey, measuring both Oh and Ah horizons. To ensure data quality, we developed our own protocol based on literature review and self-conducted test measurements. The data has been used to successfully calibrate regression models based on different forest types and soil horizons to predict the soil parameters C and N content, C/N ratio and pH-value.

To improve model performance and test its generalization capability, the created library has been extended with new samples from a field campaign conducted in 2019 at an additional local test site. Using this data, the impact of adding new information to the modelling process and the robustness of the models could be evaluated.

The results of this research will be used to assess forest sites regarding nutrients availability, as basis for the development of site specific management strategies and to enhance and improve current methods of periodic site mapping of forest stands.