Using Soil Spectra to Classify and Characterize Danish Soils

Soil is a heterogeneous and highly variable mixture due to the complex interaction of the soil-forming factors such as parent material, climate, organisms, topography, and human impact that are interacting through space and time. The complicated nature of soils represents a serious challenge when an accurate characterization of its variability is needed.

Conventional methods for soil description, sampling, and laboratory analysis of properties are expensive and time consuming. Additionally, soil description and classification involve visual and subjective examination of samples, which depend on the individual assessment of the one performing the analysis. Therefore, an alternative, more efficient and reliable method for soil analysis, classification, and description is needed.

Recent advances in soil-sensing technology can provide large amounts of high-resolution data in a cost-effective manner. To that end, the evolving soil spectroscopy discipline plays a major role in the development of such a methodology. Visible near-infrared diffuse reflectance spectroscopy (vis-NIRS), in particular, has shown to have great potential for measuring soil physical, chemical, and biological properties. This technique is faster and cheaper than conventional soil analysis, which is important especially when a large number of samples needs to be measured. Moreover, it is highly reproducible and simple to use. It does not destroy the sample, and only a small amount of soil is needed for the measurement.

The importance of spectroscopy for soil genesis, classification, and survey was recognized already in the 1980s. It was concluded that intrinsic spectral information of the soil is a consequence of its composition, giving the characterization of soil reflectance important implications for soil genesis, classification, and survey. However, most studies focus mainly on the spectroscopic modelling to predict the soil properties. Nevertheless, due to the fact that spectra contain information on the fundamental composition of soil—its organic matter and minerals—they can be used alone to describe the soil type and how it varies across landscapes.

In the March-April 2013 issue of the Soil Science Society of America Journal, researchers used vis–NIR spectra to describe and classify Danish agricultural soils and...