Title: Standards and Protocols for Soil Spectral Reflectance Measurement across the VIS–NIR–SWIR region

By Eyal Ben Dor, bendor@post.tau.ac.il

5.2 Scope:
For over 25 years, groups worldwide have been active in the soil spectroscopy arena. These groups measure soil reflectance across the VIS–NIR–SWIR (0.4–2.5 μm) region in the laboratory, mainly for chemometric purposes. As a result, many soil spectral libraries (SSLs) have been generated with local to continental coverage, each making use of different sensors and protocols(e.g. Rossel et al., 2016). As reflectance spectroscopy of soils is very sensitive to measurement geometry, illumination status, sensor output, sample preparation and more (Ben Dor et al., 2017) , merging or comparing SSLs remains a problematic issue. Nevertheless, users are still getting good (chemometric) models and do not feel the need for standards or protocols for robust soil spectral measurements. Local modeling is successful because the researchers use their own protocol under stable conditions, where systematic effects can be neglected. If systematic effects do occur, the problem is solved by spectral manipulation (mathematical) procedures. Nonetheless, the "bad data" remain, while is is not possible to track after sensor deterioration, changes in illumination, laboratory conditions, or other nonsystematic effects during the measurements. Merging and comparing SSLs from many sources is problematic due to the lack of an available and agreed upon common standard and protocol scheme for soil reflectance measurements. In addition, since hyperspectral (HSR) technology is entering a new and promising era (from both air and space domains), utilization of SSLs is becoming more and more attractive to users for direct implementation of SSL models on HSR data (Ben Dor et al. 2002, Castaldi et al. 2018). SSL standards and protocols should thus also be aligned with the HSR technology. Accordingly, the suggested sub-working group should work toward establishing a standard and protocol to measure reflectance spectroscopy of soil material.

The wide range of protocols, sensors, and measurement methods seem to complicate the merging, comparison and utilization of SSLs from many sources. Recently Ben Dor et al., 2015 proposed an operative standard and protocol that have been successfully adopted by several groups. This work paves the road for more activity in that direction. We thus propose to work toward a stage at which all users will speak the same language, agree upon the standardization action, and be able to share and compare SSLs, as well as monitor their measurement scheme before performing data manipulation or quantitative analyses. This is an extremely important stage in HSR activity for which soil has become one of the important application pillars, with SSLs playing a major role.

5.4 Purpose:
To develop a standard and protocol scheme that will be well agreed upon by the whole soil spectral and remote sensing community. The interested groups are: pedometrics, HSR, soil spectroscopy, and precision agriculture.

5.5 Need for the Project:
As many SSLs are being generated today worldwide and others are in preparation, merging them is highly important for their implementation into worldwide HSR data. Another important need

for this project is to join the SSL databases into a large homogeneous database that will cover all soil types worldwide and can be used by anyone at any time.

5.6 Stakeholders for the Standard
Several scientific communities are interested in the products as described in clause 5.4 above.

Reference

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