**Tropentag, October 6-8, 2009, Hamburg**

"Biophysical and Socio-economic Frame Conditions
for the Sustainable Management
of Natural Resources"

# Implementation of a Web-based System for Predicting Soil Fertility Constraints in Africa Using Infrared Spectroscopy

Thomas Terhoeven-Urselmans, Tor-Gunnar Vagen, Andrew Sila, Elvis Weullow, Keith Shepherd

*World Agroforestry Centre (ICRAF), Kenya*

**Abstract**

Information on soil fertility constraints is needed to target soil management recommendations especially for improved agricultural production in Sub-Saharan Africa. Case studies in many parts of the world have shown the potential of soil infrared spectroscopy for predicting functional soil properties. However, there are few examples of this fast, cheap and reliable technique being implemented in routine soil analysis. Calibration equations work well under local conditions but soils are a very complex mixture of widely varying inorganic and organic materials and new calibrations have to be built or extended when moving to new locations with different conditions. An alternative approach is to collect continental or global soil spectral libraries, which cover a vast variety of soil conditions and to centralise the work of building calibration libraries. This has been attempted over the last five years at the World Agroforestry Centre (ICRAF) in Nairobi. A network of five near-infrared spectrometers is now being established throughout sub-Saharan Africa, which will collect new soil spectra and be supported by ICRAF's central laboratory, which will provide global calibrations. This approach needs attention in respect to (i) standardised sample labeling, sample pre-treatment and scanning procedures within and across labs, (ii) efficient data storage and transfer, (iii) spectral variable reduction tools for efficient calibration with big data sets, and (iv) regression tools which deal with non-linearities in soil spectral data. Solutions for all these steps for an African soil spectral library are presented. Moreover, one approache is introduced, which deals with the representation of the uncertainty of soil property predictions based on infrared spectra. Finally, the principles of a web-based soil constraint prediction service for the ICRAF satellite infrared labs are presented and the implementation outlined.

**Keywords:** Data reduction, infrared spectroscopy, soil constraints, sub-Saharan Africa, web-based prediction service

**Contact Address:** Thomas Terhoeven-Urselmans, World Agroforestry Centre (ICRAF), United Nations Avenue, 30677-00100 Nairobi, Kenya, e-mail: t.urselmans@cgiar.org