Predicting profile characteristics with proximal sensors and a spectral soil inference system

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Proximal soil sensors are moving the domain of quantitative soil science from the laboratory into the field. To utilise these sensors effectively platforms must be developed to access sensor information and predict soil properties in near real-time. We present a framework to predict soil properties in-situ from the conjoint use of visible and near-infrared (VisNIR) diffuse reflectance spectroscopy and portable x-ray fluorescence (pXRF) spectroscopy. We further demonstrate how information from these sensors can be combined with a spectral soil inference system (SPEC-SINFERS) to greatly amplify the number of properties predicted. The effectiveness of the platform was assessed on fifteen soils across the state of New South Wales, Australia. At each location a soil pit was dug and three 1 m vertical transect surfaces were prepared at 0.5 m lateral spacing. Each transect was scanned using VisNIR and pXRF at 2.5 cm intervals to give a total of 123 (3 x 41) scans per device at each soil pit. Scanning took place under field moist conditions and bulk samples were taken at 10 cm intervals for laboratory analysis. We explore if these devices can provide effective characterisation in terms of a range of properties including: mineral composition; texture; organic carbon; pH; and cation exchange capacity. This information may be utilised in the field for improved decision making, including multi-phase mapping techniques, management zone delineation and pedogenesis investigations.