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Use of Hyperspectral Images to Map Soil Carbon

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Rapid methods of measuring soil carbon such as near-infrared (NIR) spectroscopy have gained interest but problems of accurate and precise measurement still persist resulting from the high spatial variability. Tillage and airborne-based spectral sensors can provide means to capture the spatial distribution of soil carbon in agricultural landscapes. We evaluated an airborne hyperspectral sensor covering the range from 450 to 2450 nm at 2.5-m spatial resolution and a tillage sensor covering the range from 920 to 2225 nm. We intensively sampled soils within five tilled (bare soil) agricultural fields within the flight path of the airborne sensor. The test fields were located on the Delmarva Peninsula in Maryland. The quality of spectral data acquired by these field-based sensors was compared to laboratory-acquired spectral data in both NIR (1000 to 2500 nm) and MIR (2500 to 25000 nm) spectral regions for the soil samples taken at 304 geo-referenced locations. Partial Least Squares (PLS) regression models developed from the three NIR spectral data sources were very comparable, indicating that the two field-based NIR sensors performed well for generating spatial data. Although the laboratory based MIR calibration was found to be substantially better than the laboratory derived NIR calibration, current instrumentation limitations favor the use of NIR for in field measurements. A 2.5 m resolution soil carbon map was produced for an agricultural field using the airborne hyperspectral image using PLS regression to develop the calibration model. This approach for mapping will permit better assessment of carbon sequestration in agricultural ecosystems.