METHODS FOR HIGH-RESOLUTION SOIL-LANDSCAPE MODELING IN MIDWEST UPLAND LANDSCAPES

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ABSTRACT

Traditional soil mapping concepts do not sufficiently address the spatial resolution of some soil management problems. Continuous models of soil profiles and landscapes are needed to move beyond the categorical paradigm of horizons and soil map units. This work proposes a strategy combining sensors and empirical functions of profile properties to develop high resolution 3-D models of soil landscapes. The strategy proceeds in three steps as follows: 1) estimate soil profile properties at high resolution with the combined use of a diffuse reflectance spectroscopy (DRS) sensor and several soil electrical conductivity (EC) sensors, 2) model measured or sensor predicted soil profile properties with nonlinear peak functions, and 3) map the parameters of peak functions across the landscape to produce a continuous numerical soil-landscape model. Coherent depth translation (CDT) was introduced as a method to transform and combine sparse soil profile data into a single dataset for improved modeling. These methods were tested in the upland landscapes of northern Missouri. Sensors, especially DRS, successfully estimated profile clay and organic carbon. Peak functions were valuable for modeling profile clay content and covariates of clay. Coherent depth translation enabled the modeling pedogenic trends in peak function parameters. Prototype numerical soil-landscape models were developed for a lithosequence and a toposequence of common soil series in northern Missouri.