Spatial Characteristics of Soil Quality Properties

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Objectives

The objectives of this study were to 1) quantify the spatial characteristics of soil quality properties for an agricultural field with claypan soils, and 2) evaluate if the description of spatial variation in soil quality properties could be improved by co-kriging with soil EC_a

Materials and Methods

- Study site: Centralia, Missouri, USA (39°13'48"N, 92°07'00"W)
- Soils: Adco series (fine, smectitic, mesic Vertic Albaqualfs)
  Mexico series (fine, smectitic, mesic Aeric Vertic Epiaqualfs)
- Cropping system: corn-soybean rotation with minimum tillage since 1991
- Soil sampling depths: 0 to 7.5, 7.5 to 15 and 15 to 30 cm (n=55)
- Soil testing: Db, CEC, SOC, TN, Bray1-P, aggregate stability
- ECa measurements: Hand-held EM38, Mobile EM38

- Data analysis
  - Semivariogram and cross-semivariogram analysis
  - autocorrelation analysis

Results and Discussion

Evidence of spatial dependence was lacking for many soil properties. Yet, at aseparation distance ~ 40 m clay content, silt content, CEC, and Bray1-P were spatially autocorrelated for samples taken from the 15- to 30-cm depth. Soil ECa showed a similar spatial autocorrelation. Spatial characteristics for most soil properties were better estimated by cross-semivariance analysis with ECa as a secondary variable than by simple semivariance analysis. Clay content was lowest and mostly homogeneous at the 0- to 7.5-cm soil depth (mean=170 g kg-1, SD=2.0), and highest and most variable at the 15- to 30-cm soil depth (mean=410 g kg-1, SD=15.8). Thus, the spatial characteristics of soil texture and other related soil properties varied greatly by soil depth and landscape position, likely the result of an uneven distribution of topsoil depth caused tillage-induced erosion. Sensor based ECa measurements improved accuracy when characterizing spatial variation in soil quality properties.

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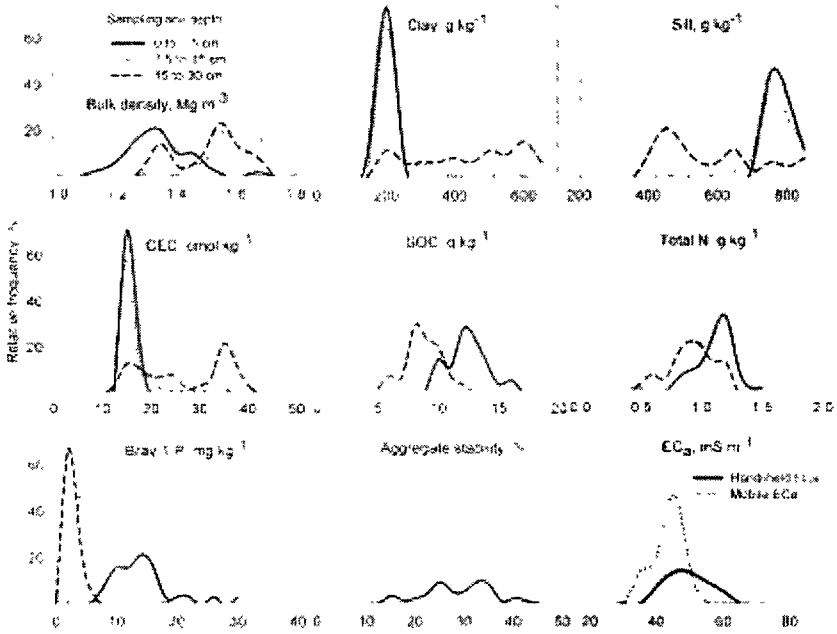

Fig. 1. Frequency distributions of soil quality properties by soil depth. Soil ECa was measured using two methods and aggregate stability was only measured for the surface depth at each location.

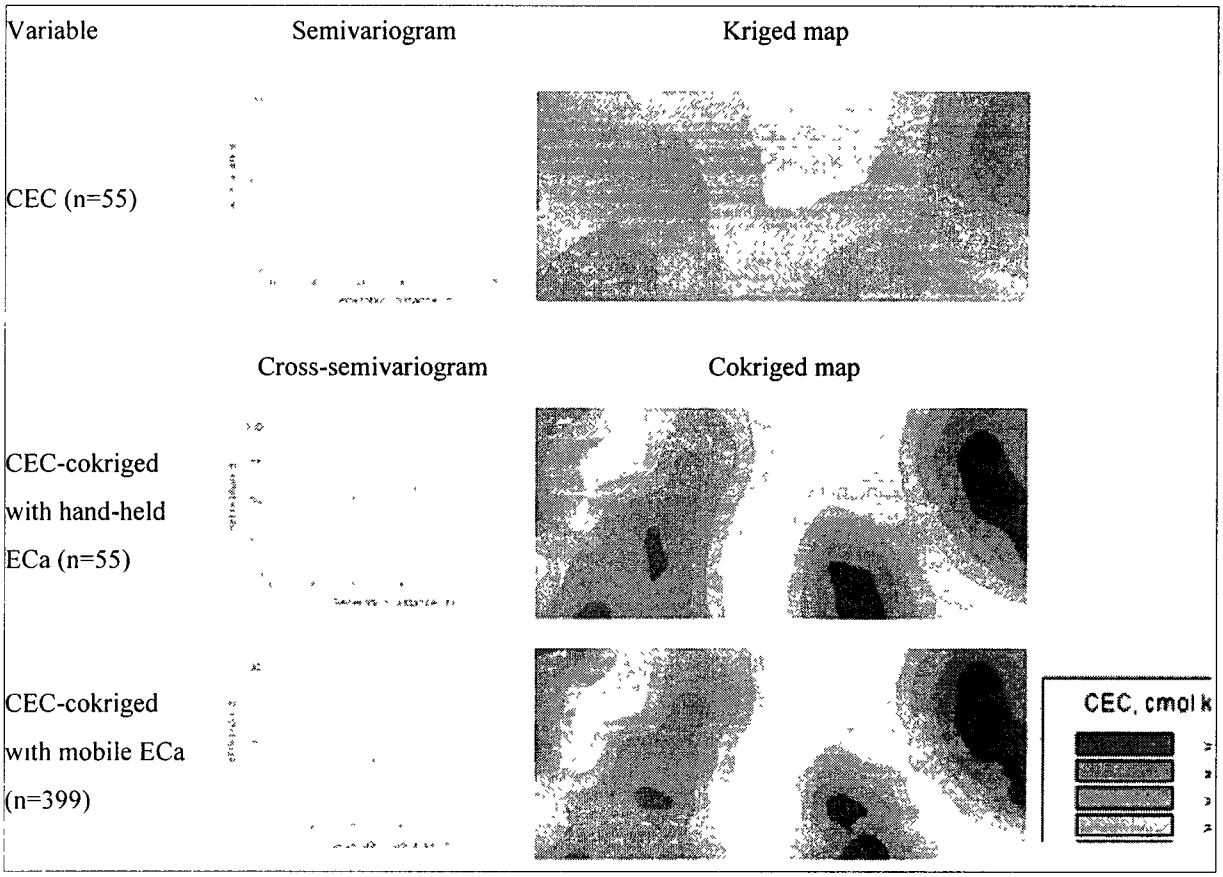

Fig. 6. Interpolated maps of 15- to 30-cm CEC obtained by kriging and by cokriging with hand-hale soil ECa and mobile ECa as a covariate