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ESTIMATION OF SOIL ORGANIC CARBON DISTRIBUTION BY GEOSTATISTICAL AND DETERMINISTIC INTERPOLATION METHODS: A CASE STUDY OF THE SOUTHEASTERN SOILS OF NIGERIA

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Abstract

Soil organic carbon (SOC) plays a significant role in ecosystem protection and sustainable agriculture. The present study aims to estimate the spatial distribution of SOC using three different interpolation methods: ordinary kriging (OK), cokriging (COK), and inverse distance weighting (IDW). Sixty ($n = 60$) soil samples were collected from the depth of 0–30 cm and analyzed for SOC. Digital elevation model of the site was obtained from USGS explorer at 30 m spatial resolution and processed. Ten (10) terrain attributes were obtained, and a correlation matrix was conducted between SOC and terrain derivatives. The whole dataset was used to evaluate the model accuracy; root mean square error (RMSE) and mean error (ME) were the criteria adopted. Mean value of the SOC of the study area was generally low when compared to the standard rating for tropical soils ($< 2\%$). SOC was significantly ($p < 0.01$) correlated with LS-factor ($r = 0.34^*$), negatively correlated with elevation ($r = -0.30^*$) and profile curvature ($r = -0.30^*$). IDW performed better (RMSE = 0.75, ME = -0.004) followed by OK (RMSE = 0.78, ME = -0.004) and then COK (RMSE = 0.94, ME = -0.067). Conversely, COK produced the model with the smallest ME with terrain attributes (elevation, LS-factor, and profile curvature). The findings in the study showed that IDW is superior in SOC estimation. COK with the terrain attributes proved to have the capacity as a useful ancillary variable for improving the spatial structure of SOC maps of southeastern Nigeria.

Keywords: interpolation, kriging, soil organic carbon, tropical soils

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