GEOSTATISTICAL ANALYSIS OF THE SPATIAL VARIABILITY OF LEVELED LIGNITE MINE SPOIL IN EAST TEXAS

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An understanding of the spatial variability of mine spoil is needed to improve sampling techniques. Core samples were taken at two sites at intervals of 3.05 m along four intersecting transects located at 0, 45, 90, and 135 degrees relative to the mine pit length. The spatial distribution of pH, lignite, carbonates, $NaHCO_3$-extractable P, DTPA-extractable Zn, and Zn concentration in millet (Pennisetum americanum (L.) Leeke) were evaluated with directional variograms. The ranges for pH of 15-90 cm samples were 22.0, 20.7, 12.2, and 30.5 m for the 0, 45, 90, and 135 degree directions at one site and <3.0, 19.8, 13.7, and 15.2 m for the same directions at the second site. Ranges were less than a single pit width. Larger ranges at the first site were related to larger spoil piles associated with thicker overburden. The elongation in the 45 and 135 degree directions corresponded to the shape and orientation of the traces of the spoil piles at the leveled surface. Cycling in the variograms reflected the location of the former mine pits. Directional variograms for extractable Zn exhibited elongation of ranges and cycling similar to the variograms for pH. The levels of pH and Zn were inferred to occur throughout the undisturbed overburden in varying amounts. Redistribution during the spoiling process created a spatial pattern related to the accretion of the spoil piles. Lignite, carbonates, and extractable P were not spatially distributed at the surface of the leveled spoil. Lignite and carbonates were inferred to be localized within the overburden in insufficient amounts to be redistributed in a spatial pattern. Directional variograms for Zn concentration in millet reflected the spatial structure found in extractable Zn. The ratio of the ranges in the 0:45:90:135 degree directions was 1.2:1.0:1.1:2.0 for Zn concentration and 1.4:1.0:1.2:2.0 for extractable Zn. This spatial interaction between Zn concentration and extractable Zn was verified with cross-variograms. Parameters that exhibit spatial dependence are not distributed independently at the spoil surface. Sampling schemes should consider both the periodicity associated with the pit locations and the spatial structure related to the configuration of the spoil piles.

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