



Spatial interpolation by Kriging technique applied to pollution assessment on soil zinc in abandoned mining site at Kinta Valley

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Abstract

Geostatistics have proven effective in providing the analyst with appropriate sets of tools for quantifying nonlinear variables with reliable results and minimum errors. These tools have been widely used in land contamination assessment and pollution mapping. This paper deals with the application of geostatistics to land inquiry about zinc pollution in the soil domain of an abandoned mining area, proposed for redevelopment, in Kinta Valley, West Malaysia. Twenty-five topsoil samples were randomly collected at average depth < 40 centimeter for chemical analysis and geodatabase development. In GIS, data processing was divided into two phases: Exploratory Spatial Data Analysis, and Geo-Statistical Data Analysis. In the first phase, the statistical properties and spatial distribution pattern of geochemical data were investigated, and Box-Cox transformation was applied to normalize the negative skewness in the data. In the second phase, the experimental semivariogram was computed for the dataset and then fitted by a theoretical Exponential semivariogram model prior to executing the interpolation. Then Ordinary Kriging model was applied for prediction and thematic mapping. The Cross-Validation test was carried out during each phase in order to ensure high performance and accurate results. The results showed that soil zinc values in the study area are generally found in anomalous level (mean = 998.6 ppm) compared to global reference values (< 2-110 ppm); indicating, thereby, high pollution conditions in the soil. The Kriging map (RMNSE = 0.9247) showed that zinc pollution has wide spatial coverage in the study area, with noticeable aggregation trend towards the eastern areas where past mining works and landscape exploitation are concentrated. The outcomes of spatial analysis suggest that the site presently is hazardous and poses potential risk to human and the environment. If the land to be reused in the coming future, local authorities in Kinta Valley need first to take action and cleans up the soil.

Keywords: Geostatistics, Spatial interpolation, Ordinary Kriging, Geochemical hazard, Pollution assessment