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## Evaluation of Metals That Are Potentially Toxic to Agricultural Surface Soils, Using Statistical Analysis in North-western Saudi

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Heavy metals in agricultural soils enter the food chain when taken up by plants. The main purpose of this work is to determine metal contamination in agricultural farms in north-western Saudi Arabia. To this end, 57 surface soil samples were collected from agricultural areas. The study focuses on the distribution and geochemical behaviour of arsenic (As), cadmium (Cd), cobalt (Co), chromium (Cr), copper (Cu), mercury (Hg), lead (Pb), and zinc (Zn), and determines the enrichment factor and geo-accumulation index; multivariate statistical analysis, including principal component analysis, and cluster analysis, are also applied to the acquired data. The GIS method was used to prepare the metals and the enrichment factor spatial distribution maps. This study shows considerable variation in the concentrations of the analysed metals in the studied soil samples. This variation in concentration is attributed to the intensity of agricultural activities and, possibly, to nearby fossil fuel combustion activities, as well as to traffic flows from highways and local roads. Multivariate analysis suggests that Cd, Cr, Cu, Hg, Pb, and Zn are associated with anthropogenic activities, whereas Cr and As are mainly controlled by parent materials. Most of the studied metals are present in concentrations exceeding the permissible limits, with Hg and Pb being the most abundant.