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Distribution of soil trace elements and potential influence on human health in North Egypt: A Spatial Study

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The Nile Delta in Egypt is one of the world's most densely populated areas with about 42.4% of Egypt's total population. Pollution of agricultural soils, water and plants by trace elements (TEs) is one of the greatest challenges to human health and food security. This study was designed to evaluate the ecological risk assessment and spatial and seasonal variations of some TEs (i.e. Cu, Fe, Mn, Ni, Pb and Zn) in the agricultural areas adjacent to Kitchener drain (one of the largest drains located in the heart of the Nile Delta, Egypt). This area is also 15 kilometers east of the UNESCO protected Burullus Lake area. Soil and plant samples were collected from seven sites close to the drain, while water samples were collected from corresponding sites inside the drain during the winter, spring and fall seasons. Standard methods were followed in analyzing all samples. Six indices were used to evaluate the ecological risk assessment for soil samples, while one index was used for plant samples. The results of TEs in soil were processed in a GIS environment to interpolate the spatial distribution of these elements in the study area. The results showed that all studied TEs in the soil varied seasonally and spatially among locations around the drain. Most of the studied soil elements were higher in the southern and middle areas around the drain. The results demonstrated that all studied elements in the soil and plant samples were highest in winter except Ni and Pb, which were almost non-detected in plant samples for all seasons. In contrast to soil and plant tissues, water samples showed low or non-detectable levels of TEs. The results also revealed that values of risk assessment indices varied among the studied TEs. The highest values closely corresponded to Cu in most studied indices indicating high concentration and high risk. However, the mean bioaccumulation factor (BAF) of all TEs was in the following order: Mn > Fe > Zn > Cu. These results revealed that there is a high risk of increasing concentration of some TEs in the study area due to anthropogenic pollution from the adjacent polluted drain. However, more studies regarding biological monitoring and pollution in food chains and their significance on human health should be performed in the future.