



2009 CSREES National Water Conference; St. Louis, MO

Heavy Metal Concentration in Surface Soils of the Flint Creek and Flint River Watersheds: An Index Analysis Approach

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Abstract:

The presence of high concentration level of heavy metals in surface soils can lead to surface water pollution. The objective of this study was to develop different types of indexes to assess the current pollution status of the FC and FR watersheds. Samples were collected from six sites in the Flint Creek (FC) and Flint River (FR) watersheds. The soil / sediment samples were analyzed using the EPA analytical method SW-6010B for total recoverable elements that are environmental contaminants of concern (such as Al, Fe, Mn, As, and Pb). The indexes used in this study were Geo-accumulation Index (I_{geo}), Enrichment Factor (EF), Pollution Load Index (PLI) and Ecotoxicological Risk Assessment for sediment dwelling organisms using consensus-based sediment quality guidelines (CBSQGs). Different indexes gave diverse status of FC and FR watershed's sediment quality. The selected total recoverable metals (TRM) were studied to determine the presence of contaminants and extent of anthropogenic (human induced) and lithogenic (derived from natural) inputs from urban and rural activities. Method quantitation limit (MQL) range from 0.273 (Pb) to 50 ppm and concentration of metals shows significant variability, 3300-25800 mg kg⁻¹ for Al; 3300-51700 mg kg⁻¹ for Fe; 56.40-2010 mg kg⁻¹ for Mn; 1.21-15.20 mg kg⁻¹ for As; and, 4.83-57.90 mg kg⁻¹ for Pb respectively. Comparison of the metal levels in the sediments from different areas of the watersheds indicates that there is a significant anthropogenic input to the FC and FR watersheds. The geo-accumulation index shows that Al, Fe, Mn, As, and Pb moderately polluted the sediments at all sites of the two watersheds.

Impact Statement:

This study shows that the major sources of metal contamination in the FR and FC are land-based anthropogenic ones, such as discharge of industrial wastewater, municipal sewage, and run-off through the watersheds tributaries. Flint River sediments appear to have higher levels of environmental contaminants than FC, however, the concentrations of most of the elements appeared to be below, and some are above biologically significant threshold levels. Nevertheless, long-term bioaccumulation of these contaminants can result in impacts and it should be cause for concern.

Category: Watershed Assessment and Restoration
Type of Presentation: Poster Presentation