Assessment of Multiple Trace Metal Fluxes in a Semi-Arid Watershed Containing Mine Tailing, Using a Multiple Tool Approach (Zaida Mine, Upper Moulouya Watershed, Morocco)

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Abstract:

Few studies have quantified the complex flux of trace metals from mine tailings to rivers through water erosion, especially in the semi-arid region of North Morocco (Zaida mine) where soil erosion is a severe issue. This study applies (i) methods to understand and estimate the complex flux of trace metals from mine tailings to rivers, using the RUSLE model combined with the concentration of trace metals in the soil and additionally (ii) pollution indices and statistical analyses to assess the sediment contamination by Cd, Cu, Pb, and Zn. Our study revealed that the basin has a low erosion rate, with an average of 9.1 t/ha/yr. Moreover, the soil contamination is particularly high at the north of the mine tailings, as prevailing winds disperse particles across the basin. The assessment of the sediments indicated that Pb is the main contaminant, with concentrations exceeding 200 mg/kg specifically downstream of the tailings. This study also identified high a concentration of trace elements 14 km away from the tailings alongside the Moulouya river, due to the specific hydrological transport patterns in the area. This research contributes to a better understanding of the transport and fate of the trace metals in mining areas. It proposes a replicable method that can be applied in other regions to assess the contamination flows and thereby assist water resource management.