

Impact of land use on heavy metal fractionation in soils and stream sediments in the Istrian-littoral river basin, Croatia

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The change of land from natural to urban or agricultural cover increases sediment discharge to river ecosystems and can result in change of stream sediment chemistry causing changes of water quality. The studied catchments are located in most part within the Palaeogene flysch basin of Istria in Croatia. A small portion of the catchments is located within Cretaceous limestones covered with terra rossa soils. Since the Middle Oligocene, the surface Cretaceous limestone has been affected by karst processes and weathering which has led to the development of both surficial and underground features. Different types of sediments, polygenetic palaeosols and soils have been formed on the karst bedrock. The study focuses on application of GIS to study of the relationships between land uses, geomorphology, erosion, water quality, and leaching experiments of topsoils, subsoils, stream sediments and suspended matter in the streams. Forest and agricultural topsoil (0-5 cm) and subsoil (40-50 cm), as well as stream sediments from 59 subcatchments of the Dragonja, Mirna and Raša rivers, were investigated, to determine the influence of different soil environments as sources metal species bound to sediments discharged into the mainstreams of the rivers flowing into the northern Adriatic. Leaching experiments have been performed on soil and sediment samples in order to recover water soluble and adsorbed trace elements or those fixed in acid soluble mineral phases such as Fe-Mn oxyhydroxides. The samples were extracted with deionised water (soil to water ratio 1:5), 0.11 M acetic acid (HAc), and *aqua regia* (ISO 11047). Generally high concentrations of heavy metals such as Cr, Ni, Zn, Co, V and Mn are found in the Mediterranean cambisols and luvisols of the Croatian coastal region, which are a consequence of the specific conditions of their formation. To estimate the degree of contamination, the procedure of calculating the Enrichment Factors (EF) for the metal was made for topsoil on the basis of backgrounds derived were compared with those obtained by using concentrations of each subsoil(40-50 cm) value. Forest topsoil was found to be enriched Pb, Hg, Cd, Mo, and Se, agricultural topsoil in Cu and Cd, while As, Ni, Zn and Tl showed no enrichment in the analysed soils. The HAc extractable Cu, Pb, Zn, Mn, As, Tl, Ni, was highest in stream sediments compared to topsoil and subsoil. The HAc extracted contents of Co, Cd, and Ba found to be the same soils and corresponding sediments. The results indicate that metal contents and extracted metal pools of stream sediments is closely associated with both the proportions of soil type, land use and the amount of runoff from agricultural, and forest areas in the catchments.