The fluvial sediment quality monitoring in the context of the implementation of 2030 Agenda in Portugal: a study in N Portugal

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Introduction: Sediment have a complex and dynamic role in a variety of ecosystem functions and services, in all aspects of the ecosystem's quality and health services, which can be positive, or negative, and that must be addressed in the management of fluvial systems at the hydrographic basin scale. Portugal, when implementing the 2030 Agenda into its national strategies, identified as priorities for SDG action with an environmental dimension: the climate change (SDG 13) and life below water (SDG 14). From all the SDG indicators being monitored at a national scale, a few are directly linked to ecosystem monitoring, management and protection (INE, 2022). The good status/ecological potential and the classification of the chemical status of surface water bodies are addressed in target SDG 6.3.2, but no evaluation is available, too short, or irregular and/or inconclusive. The targeted mean area that is protected in freshwater sites, important to biodiversity, is addressed in SDG 15, but significant challenges remain to achieve this target (Sachs et al., 2022). Anthropogenic wastewater treatment (SDG 12), as well as the proportion of municipal waste prepared for reuse and recycling (SDG 15), are targets that, indirectly, are a means of protection of freshwater ecosystems. For the latest, major challenges remain to progress on the indicator.

In this context, the present study discloses valuable information on the chemical quality of riverbed sediment from two medium-sized mountainous catchments (ca. 300 km2), located in northern Portugal, in relation to land management. Moreover, it highlights the need to include regular sediment monitoring, as an indicator of the fluvial ecosystem's quality assessment, in management plans. The conducted investigation aimed to evaluate the contamination of sediment by and to assess the ecological risk associated.

Methods: Composite samples of riverbed sediment (0-2cm: oxic layer) were collected at the end of the dry season (DS), and at the end of the rainy season (RS). The fraction <63µm was separated by wet sieving and studied for As, Cd, Co, Cr, Cu, Ni, Pb, Zn and V. Total contents were determined after aqua regia digestion. To assess potential mobility and possible origins (natural and or anthropogenic), a sequential chemical extraction approach, modified from Tessier et al. (1979) was used, considering five geochemical fractions. The elements' concentrations were obtained by ICP-OES. The sediment quality guidelines – SQGs - for freshwater ecosystems were considered, and the risk assessment indices were calculated, to assess the environmental risk associated with total and labile contents of metals.

Results and Discussion: The studied catchments are subject to different microclimates and anthropogenic pressures: a) River Vizela catchment, located in the Northwest, has a strong industrial component in the textile sector, the agriculture has a strong component in milk production and a crop system subject to animal manure application; b) the River Vilariça catchment, in the Northeast, has a strong agricultural component focused on the production of vegetables, vine and fruit trees, with increase intensification due to the strengthening of the Irrigation System. The results showed that Cd, Pb, and Cu presented higher potential risk of mobility to the water column and represent a potential threat to the aquatic ecosystems. For Cd in particular, this potential risk is confirmed by its contents concentrated mostly in the soluble phase, as an exchange cation, above PEL values in the dry season, in both catchments. According to the Risk Assessment Code (RAC) data, Cd was the most labile metal in the sediment samples and represents a very high ecologic risk, in a significant part of the samples. Copper, Pb e Zn represent medium risk.

References: [1] INE (2022). Instituto Nacional de Estatística - Objetivos de Desenvolvimento Sustentável - Agenda 2030. Indicadores para Portugal: 2015-2021. Lisboa: INE.; [2] Sachs et al. (2022): From Crisis to Sustainable Development: the SDGs as Roadmap to 2030 and Beyond. Sustainable Development Report 2022. Cambridge: Cambridge University Press.