Historical metal pollution in a newly urbanized watershed in southern Brazil

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Abstract

The pollution of rivers and lakes in developing countries is considered one public health and environmental problem in the urban regions. Studies of historical pollution of these environments help to understand the effects of anthropization on the growth of medium and large cities. In an urban lake, Arthur Thomas lake, in southern Brazil, Paraná state, a sediment core was sampled, dated and the presence of 27 trace elements was assessed. Accumulation of metals and the level of pollution was measured by the Geoaccumulation Index (Igeo) and Enrichment Factor (EF) for the period from 1914 to 2012. The lake showed EF between 5 and 45, Igeo class = 2 – 6 and high concentration to Ag, Se, Na, Au, S, Ca, Mg, Ba, Sb, Bi and Sr. The EF to Au = 45 and Ag = 40 caused by urbanization in the watershed. In another hand, the elements Fe, Al, As, Cr, Ga, La, Sc, Th obtained Igeo ≤ 0 and EF ≤ 1.6. A principal components analysis and Spearman correlation showed a first group with Ca, Mg, P, Ba, Sr, Na, K, Ag, Bi, Au, Mo, sand, silt and total organic carbon with positive correlation ≥ 0.70 and > 0.95 to Sr, Ag, sand and silt, and these were negatively correlated ≥ - 0.70 with Fe. The second group: Fe, La, Ga, Ti, V, Cr, As, Al, Th from lithogenic source. The prediction models with R2 > 0.65 for the high concentration for the elements Mg, Na, P, Sr, Fe, Ga and Total Organic Carbon to years 2020 – 2050. In the anthropogenic sources analyses a watershed land use map indicates multiple uses of the land, with 52.57 % urban area, 14.5 % forest and 14.6 % agriculture with the use of agricultural pesticides at the cultive of soybeans, corn and grains.

Image

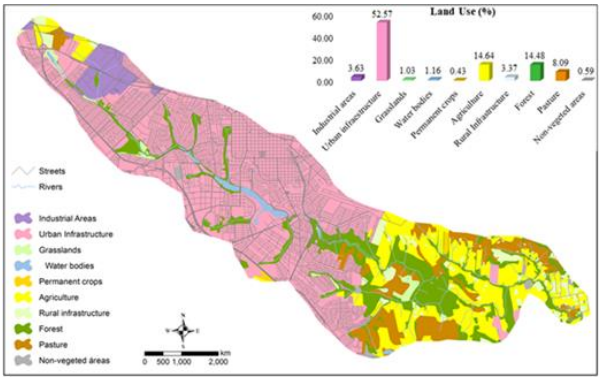


Figure 1: Map of land use for the Cambé River watershed, Brazil.

Recent Publications

1. Bárcena, J. F., Claramunt, I., García-Alba, J., Pérez, M. L., & García, A. (2017). A method to assess the evolution and recovery of heavy metal pollution in estuarine sediments: Past history, present situation and future perspectives. Marine Pollution Bulletin, 124(1), 421–434.
2. Bing, H., Wu, Y., Zhou, J., Li, R., & Wang, J. (2016). Historical trends of anthropogenic metals in Eastern Tibetan Plateau as reconstructed from alpine lake sediments over the last century. Chemosphere, 148, 211–219.
3. Pajević, S., Arsenov, D., Nikolić, N., Borišev, M., Orčić, D., Župunski, M., & Mimica-Dukić, N. (2018). Heavy metal accumulation in vegetable species and health risk assessment in Serbia. Environmental Monitoring and Assessment, 190(8).
4. Vieira, L. M., Rizzi, J., do Couto, E. V., Souza, D. C., Ferreira, P. A. L., Figueira, R., & Froehner, S. (2018). Historical Pollution of an Urban Watershed Based in Geochemical, Geoacumulation, and EROD Activity in PLHC-1 Analyses in Sediment Cores. Archives of Environmental Contamination and Toxicology. https://doi.org/10.1007/s00244-018-0573-3
5. Wang, G., A, Y., Jiang, H., Fu, Q., & Zheng, B. (2015). Modeling the source contribution of heavy metals in surficial sediment and analysis of their historical changes in the vertical sediments of a drinking water reservoir. Journal of Hydrology, 520, 37–51.



Biography

Graduated in Environmental Engineering (2004), Master in Environmental Science and Technology (2007) and PhD in Water and Environmental Engineering from the Federal University of Paraná (UFPR) with an exchange period, Institute of Environmental Assessment and Water Research, from CSIC, Barcelona, Spain (2014). I am currently a professor at the Federal Technological University of Paraná (UTFPR), at the Academic Department of Biodiversity and Nature Conservation (DABIC), where he teaches: Sanitation and Hydrology. I have expertise in the area of pollution of aquatic environments.

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