

Integrated CCME–WQI and GIS-Based Assessment of Surface Water Quality for Drinking Purposes along the Right Bank of the Senegal River, Mauritania

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ABSTRACT

The increasing pressure on surface water resources driven by rapid population growth, agricultural intensification, and urban expansion poses major challenges to water availability and quality in the Senegal River basin. This study examines the spatial and seasonal variability of surface water quality along the Mauritanian reach of the Senegal River during two contrasting hydrological periods: the high-water season and the low-water season. Surface water samples were collected from six representative stations and analyzed for heavy metals, physicochemical parameters, nutrients, and organic pollution indicators. The results were compared with World Health Organization (WHO) guidelines and Adour–Garonne Water Agency standards and synthesized using the Canadian Council of Ministers of the Environment Water Quality Index (CCME-WQI) to assess drinking water suitability. The findings reveal a marked degradation of water quality, particularly during the high-water period, characterized by critical levels of heavy metals, with iron, manganese, and chromium concentrations far exceeding permissible limits, as well as extreme turbidity (>2000 NTU) and severe nutrient enrichment, including nitrate concentrations up to 254 mg/L, nitrites up to 1.6 mg/L, and phosphates reaching 12.68 mg/L, reflecting strong agricultural and domestic pollution inputs. CCME-WQI values ranged from poor to marginal during low water and were consistently classified as poor during high water, indicating that the river water is generally unsuitable for drinking without treatment. The superposition of thematic layers in a GIS framework allowed the detection of pollution hotspots linked to localized human activities. These results highlight the urgent need for continuous monitoring, effective pollution control, and integrated water resource management to protect this vital water resource.

Keywords: Surface water quality; Seasonal variability; Nutrient pollution; Heavy metals; CCME Water Quality Index (CCME-WQI); GIS; Senegal River; Mauritania