



FROM CATCHMENT TO STREAMBED: URBANIZATION AND SUBSTRATE STRUCTURE JOINTLY SHAPE MICROPLASTIC POLLUTION IN SUBTROPICAL STREAMS

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Introduction: Microplastics are emerging contaminants in freshwater systems, with recognized potential for bioaccumulation and ecotoxicological effects. However, the mechanisms governing their distribution in subtropical stream sediments remain poorly understood. This study investigated the abundance, size, and color of microplastics in streambed sediments, and their relationships with land use and local physicochemical conditions. **Methodology:** Sediment samples were collected from 30 sites during two sampling campaigns (November 2022 and April 2023). Land use and land cover were quantified using geospatial analysis, and sediment granulometry was characterized by sieving. Organic matter was removed using hydrogen peroxide (H₂O₂) digestion, followed by density separation with sodium iodide (NaI). Extracted microplastics were quantified and classified by size and color. Relationships with environmental predictors were assessed using regression trees and Principal Component Analysis (PCA). **Results and Discussion:** Transparent and black microplastics were the most abundant and exhibited larger particle sizes, likely reflecting their widespread use in consumer products and higher resistance to degradation. In contrast, red particles were smaller and less frequent, suggesting either limited sources or reduced environmental persistence. Microplastics abundance was primarily associated with urban land cover and, secondarily, with water turbidity. Particle size was influenced by substrate composition (notably pebble proportion), silviculture, water temperature, and urbanization. PCA results reinforced that urbanized catchments with higher turbidity tend to accumulate both greater microplastic loads and larger particles. **Conclusion:** These findings indicate that catchment-scale land use drives Microplastic input into streams, while local sediment characteristics regulate particle



retention and fragmentation. Overall, our results highlight the need for integrated management strategies that mitigate both large-scale sources and local-scale processes controlling microplastic dynamics in freshwater ecosystems.

funding source: CNPq; FAPESC; Unochapecó; Casan.

Keywords: *Aquatic Ecotoxicology; Anthropogenic Impact; Environmental Monitoring; Sediment Dynamics; Watershed Processes.*