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Mapping waste flows and leakage pathways in the Lake Victoria basin

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Abstract

Sustainable waste management is increasingly critical for maintaining the integrity of agro-ecosystems, particularly in rapidly urbanizing regions where mismanaged waste contributes to soil, water, and ecosystem degradation. In many parts of sub-Saharan Africa, including the Lake Victoria Basin in Kenya, waste planning is constrained by limited and fragmented data on waste generation, composition, and leakage pathways. This restricts the ability to assess environmental risks and design effective interventions to protect water bodies and surrounding agricultural systems. This study examines the application of WasteWise, a web-based decision-support tool, to analyse waste burdens within the Kenyan Lake Victoria Basin. The tool integrates spatial and non-spatial data inputs to generate outputs including waste flow profiles, spatial distribution patterns, and estimates of waste leakage into the environment. These outputs are used to quantify waste burdens and identify high-risk zones contributing to pollution of the lake and its surrounding landscapes. The analysis provides location-specific insights into waste generation rates, composition, and spatial variability, with particular attention to organic fractions that affect both environmental quality and resource recovery. By mapping leakage pathways and identifying hotspots, the tool supports a better understanding of how urban waste systems interact with aquatic ecosystems and downstream agricultural environments.

The findings highlight the scale and spatial concentration of waste-related pressures within the basin and demonstrate how improved data structuring can support more informed planning and environmental management. In particular, the results underline the importance of integrating waste management into broader agro-ecosystem and water management strategies. This study contributes to the ongoing CGIAR Multifunctional Landscape Science Program in Kenya and discussions on climate-resilient and multifunctional agro-ecosystems by illustrating how digital tools can support the quantification of environmental pressures and inform context-specific responses in data-constrained settings.

Keywords: Agro-ecosystems, decision-support tools, environmental pollution, leakage pathways, resource recovery, waste flows

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