

Nutrient source tracking in a mixed land use watershed in young, high volcanic island, Hawaii, US

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Coastal springs are on the downstream end of catchments and their geochemistry integrates upstream processes. Our study focuses on the evolution of water composition along a mixed land use coastal watershed on the island of Hawaii, USA. Due to the multiple possible sources of excess nutrients, unfortunately single source tracking methods do not provide conclusive results. We sampled wells and coastal springs in a basalt aquifer to determine the spatial pattern of dissolved nutrient concentrations and we used contaminants of emerging concern (CEC) associated with wastewater and landscaping practices to look for direct linkages to these two major nutrient sources. For each spring we calculated indices to communicate the likelihood of a type of nutrient source. Nitrogen and phosphorus were found in excess of ambient levels in several coastal springs, and we observed almost doubling of nutrient loads compared to groundwater above the coastal development. Most prevalent CECs associated with wastewater were caffeine (detected in 49% of springs) and sulfamethoxazole (33%), while linkages with landscaping practices were identified most frequently through detection of glyphosate (37%). Results were compared to predicted patterns from spatial land-use analysis, and demonstrated a more prevalent wastewater and landscaping signature than what land-use analysis suggested. While spatial models have previously been used to predict coastal nutrient levels, our sampling suggests that specific wastewater and landscaping sources may be missed in this modeling approach. Direct observations with a multi-parameter sampling approach identify potential areas for wastewater management or improved landscaping management practices that would otherwise be missed.