Spatial analysis for identifying hotspots of EDC and PPCP sources for developing monitoring systems

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Endocrine disrupting chemicals (EDCs) and pharmaceuticals and personal care products (PPCPs) are emerging contaminants of increasing concern. Municipal wastewater treatment plants (WWTPs) are considered as the primary EDC/PPCP contaminant sources while other significant sources may include nonpoint sources such as agriculture and urban runoff (Jjemba, 2008). Therefore, a watershed approach to considering all these sources is necessary to develop effective monitoring and management strategies for EDCs and PPCPs. This study aims to identify EDC/PPCP sources and hotspots using geographic information system (GIS) spatial analysis.

In this study, the Lake Mead watershed was analyzed because historical data including monthly monitoring of EDCs and PPCPs from the past decade are available. The Lake Mead Watershed is located between Nevada and Arizona, with an area of 12,369 km_2. The watershed consists mainly of rangeland (76%) and forest (16%) as shown in Figure 1.

GIS layers for land use and potential sources of EDCs and PPCPs – including WWTPs, septic and NPDES permit point sources – were obtained for clustering analysis using Getis- Ord (1992)'s *Gi** statistics. Results from spatial statistical analyses identified the most susceptible sub-basins of the watershed to EDC and PPCP contamination. The results also identified sub-basins with high potential for EDC/PPCP discharge to the lake. Clusters of potential EDC/PPCP contamination from point sources were concentrated, whereas clusters of potential EDC/PPCP contamination from nonpoint sources were spread throughout the watershed. These results emphasized the impact of point source pollution in the watersheds on the EDCs/PPCPs in lake water. The spatial analysis results were compared to EDC and PPCP measurements at different sampling locations (Figure 2). The monitoring measurements showed higher concentrations in Las Vegas Wash, which is close to the outlets of the sub-basins with highest priority. The results validate the selection of the existing monitoring sites by the local agency. Our approach will be useful for determining monitoring locations and management of EDCs and PPCPs throughout the watershed.

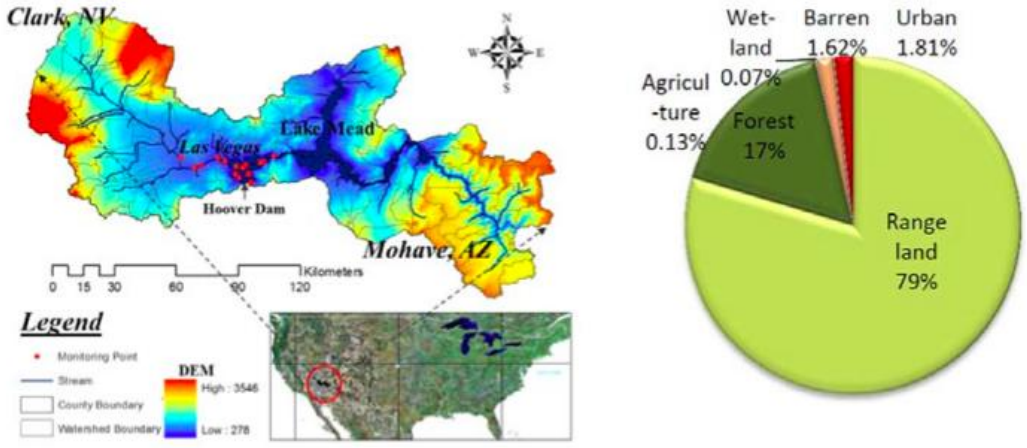

Figure 1 The location of the Lake Mead Watershed and its land use

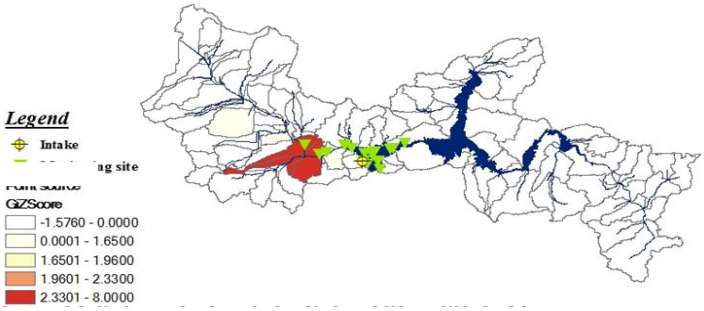

Figure 2 Hot spot analysis

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