Risk Zone Modelling of Lake Ecosystem Using Multi-criteria Assessment to Determine the Ecosystem Degradation Levels of Selected Urban Lakes, Sri Lanka

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Despite the great advances that have been made in freshwater ecosystem protection, anthropogenic effects on inland waters remain one of the most obvious and prevalent threats. Inland waters and surrounded wetlands in Colombo city play a major role in conserving urban biodiversity. Adverse effects of development activities and pollution on biodiversity of the ecosystem is a known fact. Identifying these external factors and demarcating the risk zones are critical to conserve and manage the wetland ecosystems. Thus, the objective of this study is to apply a multi-criteria assessment technique to model the risk zones in selected lake ecosystems and surrounding wetlands. Three lakes (Thalangama Lake, Boralesgamuwa Lake, and Kesbewa Lake) along with the surrounding wetlands were considered for the study. Remote sensed data extracted from Landsat satellite images and secondary data along with field observations were used. Urban vegetation, building density, population density, temperature, plant water content, lake area changes, the spread of invasive species and water quality were selected as the criterion to assess. GIS, remote sensing techniques (NDBI, NDVI, RVI, NDMI, NDWI, MNDWI, LST, elevation and population parameters as the criterion), and C map tools were used for the analysis. The multi-criteria assessment using the overlay and interpolation methods were used to model the risk zones. The risk zones were identified from the developed maps and the risk areas were categorized. The very high-risk severity indicates the low dense vegetation, high LST, plant water stress, building density, and land use and land cover changes. The very high-risk level was positioned around the lake ecosystems. The largest critical zone is found around Thalangama lake ($10.80km^2$). As per the findings, all three urban lake ecosystems were degraded and are located at environmentally risk zones. Among them, being an Environmental Protection Area, the Thalangama lake is at a critical phase. Urban expansion, the transformation of vegetation to the synthetic environment and population expansion are lucid in these areas. The study recommends the application of modified DPSIR (drivers, pressures, state, impact, and response model of intervention) to further identify conservation measures to avoid or minimize the degradation process or root causes.

Keywords: Urban freshwater Lake degradation, Modified DPSIR, Multi-criteria assessment-risk zoning