Mapping Sustainability: Water Quality Monitoring and Restoration of Bengaluru's Lake Ecosystems

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ABSTRACT

The lakes of Bengaluru, once vital to the city, now face severe degradation due to urbanisation, jeopardising sustainability, biodiversity, and public health. This study aims to rejuvenate Bengaluru's lake ecosystems by integrating geospatial technologies, water quality metrics, and machine learning methodologies. A watershed in a Bengaluru valley was selected to analyse the geographical and temporal dynamics of lake health and recommend feasible rejuvenation measures. Geospatial techniques, including GIS, were used to extract indices such as the Normalised Difference Water Index (NDWI), Normalised Difference Vegetation Index (NDVI), and Environmental Water Index (EWI) to monitor hydrological and ecological aspects.Water quality parameters, including Dissolved Oxygen (DO) and turbidity, were assessed through spectral data and laboratory analysis, with Central Pollution Control Board (CPCB) data to improve reliability. A machine learning framework was developed to estimate DO and turbidity directly from spectral data, offering a scalable, cost-effective approach to water quality assessment. Results revealed a concerning decline in water quality, characterised by increased turbidity and reduced DO levels due to untreated wastewater and the degradation of vegetative buffers.The study proposes a comprehensive framework for lake rejuvenation, including restoring natural hydrology, rebuilding wetlands as biofilters, and managing urban watersheds to reduce pollutant loads. A community-based stewardship model is also advocated to ensure sustainable conservation efforts. This work highlights the urgent need to rehabilitate Bengaluru's lakes, presenting a reproducible, data-driven model for transforming urban water bodies into sustainable ecosystems while setting a global benchmark for lake restoration.

Keywords: Geospatial Analysis, Land Cover, Land Use, Remote Sensing, Water Quality