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A Predictive Model Derived from Sattellite Data and Selected Water Quality Parameters for Invasive Plant Dynamics in North Bolgoda Lake

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Abstract

The proliferation of aquatic weeds and algae in water bodies, such as Water Hyacinth coverage in North Bolgoda Lake, underscores potential pollution concerns associated with prolonged plant growth on surface water, changing nutrient levels and subsequently the water quality. This study aims to develop a regression model employing remote sensing techniques to identify and map the spatial distribution of invasive plants, primarily Water Hyacinth, in North Bolgoda Lake. Integration of surface temperatures derived from the Thermal Infrared (TIR) band of Landsat-8 satellite data facilitated by the field measurements of selected parameters are the main components of this research. Utilizing TIR band 10 data, converted into Lake Surface Water Temperature (SWT) imagery, alongside the surface water temperature measurements from pre-identified locations and computed Dissolved Oxygen (DO) and Chemical Oxygen Demand (COD) values for the same locations includes the main data used for the study. Lake SWT and DO, COD gathered from 30 locations during February and March 2024, revealed a linear inverse correlation between Lake SWT, COD, and DO. A composite map was generated for the selected locality of the North Bolgoda Lake with all the above information including provisions for precision enhancements by continuing insertion of field data. Despite the involvement of limited parameters this dynamic map could serve as a preliminary model for recognizing the behaviour of invasive plants and their impact on the selected elements of the waterbody. Further, this could be extended to determine the lake bottom dynamics, behavioural characteristics of the water column and the potential for encountering contaminations. It is recommended to develop this map by including further parameters and replicate the same methodology to cover the North Bolgoda Lake extent to assist authorities to make informed decisions. This study merges the satellite-derived data with ground-truth measurements to validate and refine the predictive models, ensuring their accuracy and reliability in forecasting. Utilizing spatial autocorrelation techniques this predictive framework could be further improved.

Keywords: Landsat-8; Surface water temperature; Dissolved Oxygen; Chemical Oxygen Demand; Auto-correlation techniques