Determining the Invasive Plant Dynamics in Bolgoda Lake Using Open-source Data

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Identifying invasive plants (IP) and monitoring their dynamics is essential to minimize potential adverse effects on natural resources. Remote sensing (RS) could effectively cater to such requirements by acquiring data in many critical domains. Limitations of spatial resolution, spectral information, and large imagery files usually hinder retrieving, managing, and analyzing remotely sensed data. The cloud-based computational capabilities of Google Earth Engine (GEE) provide the amenities for geospatial data analysis, retrieval, and processing with access to a majority of freely available, public, multi-temporal RS data. Integrating machine learning algorithms into GEE generates a promising path toward operationalizing automated RS-based IP monitoring by overcoming traditional challenges. Use of Classification and Regression Trees (CART) classifier to generate water-vegetation classification over six years (2016-2021) with Landsat 8 and Sentinel 2 images enabled mapping the invasive plants and their dominant component of Water Hyacinth (Pontederia crassipes) across a heterogeneous landscape in Bolgoda Lake, Sri Lanka. Also, the study could develop a relatively accurate classification of the water-vegetation dynamics over the time of interest. The classified time series data indicates the annual variation of the water, vegetation, and non-vegetation classes with rapidly fluctuating seasonal cycles for the vegetation cover. These results could benefit regulatory authorities and institutions to optimize environmental resource management and prioritize eco-preservation attempts. Moreover, the findings reflect the capabilities of deep learning models to identify invasive plant behaviors even with modest spatial and spectral resolution imagery.

Keywords: Freshwater resources, Machine learning, Spatiotemporal dynamics, Water hyacinth