

## **PREFACE**

An indispensable tool for clear interpretation and communication is data visualisation. A platform for a useful monitoring site visualisation system is offered by GEE. The Sundarbans, a UNESCO World Heritage site, is the largest tidal halophytic mangrove forest in the world. It plays a crucial role in protecting the coastal areas from erosion, storms, and cyclones. However, it faces significant threats from climate change, sea-level rise, pollution, and human encroachment, making sustainable management and conservation efforts critical for preserving this unique and vital ecosystem. This current study explores the use of remote sensing and GIS technologies for monitoring water quality variations and visualizing water surface area in the Sundarbans, a critical and vulnerable ecosystem. Leveraging Sentinel-2 satellite imagery, SAR data, and Google Earth Engine, we developed an interactive tool to assess indices which in turn would provide insights on water quality and the SAR image classification to provide a count on the number of inundated pixels of a particular day of any year between 2017 to 2023. Here, we analyzed four indices: Normalized Difference Water Index, Normalized Difference Turbidity Index, Normalized Difference Chlorophyll Index, and Modified Normalized Difference Water. This tool offers real-time, spatially extensive data, addressing the limitations of traditional, point-specific methods. Allowance to work with historical data adds on to the versatility of the application. The interactive visualization features dynamic mapping of water surfaces using SAR imagery, allowing users to analyze temporal patterns and anomalies across various water bodies. Results revealed significant seasonal and annual variations in water quality and volume. These findings provide critical insights for water resource management, conservation efforts, and climate change adaptation.

**KEYWORDS:** Sundarbans; Water Quality; Water Surface Area; Water Indices; Sentinel 2; SAR; GEE; NDTI; NDVI; NDCI; MNDWI; Interactive User Interface; GEE App