Spatio-Temporal Analysis of Land Use Transformation in the Haputale DS Division Using Remote Sensing and GIS

A. Pradeepa

Department of Geography, University of Peradeniya, 20400, Sri Lanka
a20516@arts.pdn.ac.lk

Land use and land cover (LULC) changes have become a significant environmental concern in ecologically sensitive regions such as the Haputale DS Division in Sri Lanka due to their potential impacts on biodiversity, water resources, and sustainable development. Understanding these changes is important for effective environmental planning and management. This study aimed to analyze the spatial and temporal patterns of LULC changes in the Haputale DS Division over a ten-year period using Remote Sensing (RS) and Geographic Information System (GIS) techniques. A quantitative research approach was employed using Landsat satellite imagery from 2014 and 2024. The images were preprocessed through geometric correction, atmospheric correction, and clipping procedures. Supervised classification in ArcGIS Pro was used to classify the study area into four LULC categories: Water, Forest, Developed, and Cultivated land. Change detection analysis was performed to identify changes between the two time periods, while classification accuracy was assessed using confusion matrices based on 100 randomly selected reference points for each year. The results revealed notable changes in land-use patterns during the study period. Forest cover decreased by 51.4%, while water bodies declined by 80.4%. In contrast, cultivated land increased by 29.6%, and developed areas expanded by 20.8%. The classification accuracy was 81% for 2014 and 73% for 2024, indicating acceptable classification performance with some limitations in the latter classification. These changes indicate substantial land-use transformations that may be associated with increasing human activities and land-use pressures in the study area. The findings contribute to understanding land-use dynamics and highlight the need for integrated land management strategies, including sustainable agricultural practices, reforestation, proper urban planning, water conservation, and regular RS-based monitoring to support long-term environmental sustainability.

Keywords: Land Use and Land Cover (LULC), remote sensing, GIS, change detection, environmental sustainability