

Title: Dynamic assessment and prediction of land use alterations influence on ecosystem service value: A pathway to environmental sustainability

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Abstract: In the face of rapid urbanization, understanding and managing changes in Land Use and [Land Cover](#) (LULC) is crucial for the [sustainability](#) and resilience of urban ecosystems. Rapid urban growth resulting from changes in LULC, can lead to the fragmentation and degradation of Ecosystem Services (ES), including habitat provision, water regulation, and air [purification](#). This study investigates LULC changes in Dhaka City, Bangladesh, from 2010 to 2021 and forecasts their future impacts on ES in 2030 and 2040. [Landsat](#) images were processed using the [Google Earth Engine](#) platform, and a [cellular automata](#) technique was integrated with an Artificial [Neural Network](#) (ANN) for LULC mapping and prediction. Results showed an increase in built-up areas from 31% to 42% between 2010 and 2021, with a projected decrease to 34% and 32% in 2030 and 2040, respectively. [Water bodies](#), vegetation, and [agricultural land](#) declined from 2010 to 2021 but are expected to increase in 2030 and 2040. This trend indicates a growing awareness of the need for a sustainable environment and resilience in urban ecosystem development. The value of ES is predicted to drop from \$172.66 to \$160.23 over thirty years (2010–2040), primarily due to the degradation of water bodies (\$7.64) and agricultural land (\$6.89). However, the projected increase in water bodies, vegetation, and agricultural land by 2040 suggests a potential for recovery and enhancement of these ES values through sustainable practices. Future land use policies should promote [sustainable agriculture](#) and [water resource management](#) while fostering resilience against rapid urban growth. This approach will ensure the sustainable development of urban ecosystems. This study informs future land use strategies in Dhaka City, supporting sustainable [natural resource management](#), urban ecosystem quality management decisions, and resilience planning. It underscores the importance of integrating sustainability and resilience into urban development policies for the benefit of both the environment and the city's inhabitants.

Keywords: Land Use and Land Cover (LULC) Urbanization Ecosystem Services (ES) Dhaka City Artificial Neural Network (ANN) Cellular automata

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