

An Assessment of Urban Expansion through the Integration of Remote Sensing Data and the Relative Shannon Entropy Model in GIS: A Case Study of Mirissa Tourism City in Sri Lanka

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Abstract

Urban expansion, defined as the increase in the built-up area of settlements accompanied by population growth, has a long history influenced by human activities. However, in densely populated areas, urban growth can occur without physical expansion, while urban expansion can occur without substantial population growth due to densification. The developing world has experienced rapid growth across various industries, with tourism emerging as a significant and expanding global sector. Unplanned urban expansion has led to the issue of urban sprawl, which has become a prominent topic in various scientific disciplines. This study focuses on investigating the expansion of Mirissa Tourism City. The primary objective is to determine urban land expansion using Shannon's Entropy value. Remote sensing and Geographic Information Science (GIS) techniques offer methods to assess expansion indices using satellite imagery. Satellite images from 2005, 2010, 2015, and 2020, obtained from United States Geological Survey (USGS) Earth Explorer, and were used as primary data sources. The Normalized Difference Built-up Index (NDBI) was employed to extract the built-up areas and calculate urban expansion/urban sprawl, enabling the identification of expansion patterns in the study area. The findings include the generation of maps depicting the expansion of built-up areas in Mirissa Tourism City, revealing the urban expansion using Shannon's entropy value. Incorporating such analysis into town planning allows for the identification of extension patterns that promote sustainable development. The results indicate that the region experienced a slight expansion between 2005 and 2010, followed by a moderate rate of expansion from 2010 to 2015 and in 2020. Ultimately, the output highlights that urban expansion predominantly occurred from the beach-side towards the city center area in Mirissa Tourism City.

Keywords: *GIS, NDBI, Remote Sensing, Shannon's Entropy, Urban Expansion, Urban Sprawl*