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Contours of Climate: Unraveling the Urban Blueprint Behind Heat Islands

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Abstract

As cities have become epicentres of heat islands amidst rapid urbanization, this study examines the complex interplay of urban form and Land Surface Temperature (LST) to identify growth patterns of the Urban Heat Island (UHI) effect. Focusing on Siliguri, Asansol, and Haldia - three Indian cities with distinct spatial and climatic profiles - we explore how urban structure influences Urban Heat Island (UHI) effects and how these patterns have shifted over the last three decades. The urban forms of these three cities - Haldia, a major port and petrochemical centre; Asansol, an industrial town with a large mining and manufacturing sector; and Siliguri, a rapidly expanding commercial and transportation hub - differ greatly. Each city's mix of industrial, commercial, and residential areas creates unique UHI dynamics that vary based on built environment and urban growth patterns. Our research highlights the critical roles of building height, density, and biologically vital areas in shaping urban thermal dynamics. GIS analysis reveals how changes in Land Use Land Cover (LULC), including diminished vegetation and increased building density, elevate temperatures and exacerbate UHI. Identifying these elements offers valuable insights for climate-resilient urban planning. By emphasizing climateconscious design, this study advocates for urban environments that support ecological balance and comfort. Our findings aim to inspire sustainable city growth, where urban expansion is harmonized with environmental stewardship - fostering resilient, more relaxed, and healthier cities amidst climate change.

Keywords: building density; building height, urban heat island (UHI); urban morphological indicators (UMI); urban thermal dynamics