Spatial Pattern and Correlation Analysis to Understand the Relationship of City Structure on the Urban Heat Island (UHI) Intensity Across the US

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The rapid growth in urbanization over the past few years has caused the Urban Heat Island (UHI) phenomenon- an occurrence where the temperature of an urban area is significantly greater than the temperature of the surrounding rural areas. This increase in temperature causes an increase in energy consumption, negative health impacts, and a rise in air pollution and also negatively impacts water quality. As more and more people move into cities, housing patterns and accessibility factors shape the development of neighbourhoods within a city, which are mainly governed by socio-economic factors. It has been shown that disadvantaged communities are exposed to hotter temperatures within a city, which can potentially be exacerbated by UHI. In an urbanized area, the structure of neighborhoods may cause variability in UHI across the city. However, the influence of urban structure on UHI has not been fully investigated. The objective of this research is to study how the spatial patterns within a city affect UHI and analyze these relationships for cities across the United States. The research hypothesizes that spatial patterns of cities have a strong and positive correlation with the intensity of UHI. Landscape metrics that are indicators of city structure derived from landcover data are correlated with UHI derived from satellite data for various cities across the US. It is observed that many of the metrics have a strong correlation with UHI, proving the hypothesis correct. Of these metrics, the Percentage of Land Cover (PLAND), Number of Patches (NP), and Edge Density (ED) are shown to be particularly influential. These findings can prove useful in determining how city planning can be done to mitigate the impact of UHI and ensure environmental justice amongst its population.

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