A Systems Approach to Heat Inequality in Delhi: Mapping Urban Heat Risk and Governance Gaps in Delhi

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Abstract

As global temperatures rise and extreme heat events become more frequent and intense, the impacts of heat are increasingly recognised as a challenge of **urban inequality**. Heat, however, is not experienced uniformly within cities. This study examines how Delhi's rising baseline temperatures and increasing heat extremes interact with the city's uneven patterns of vegetation, settlement, and built form to produce spatially differentiated heat exposure, with implications for public health, livelihoods, and productivity.

Using a **systems-thinking approach**, the study investigates where this burden is most heavy and visible and what this means for how the city plans, designs and governs urban cooling. The study models the association between vegetation cover using Normalized Difference Vegetation Index (NDVI) and land surface temperature (LST) across 979 spatial observations, using Landsat 8 satellite imagery processed through Google Earth Engine (GEE) and QGIS. The finding suggests a statistically significant inverse relationship ($R^2 = 0.24$, $p < 0.01$) between NDVI and LST, with 0.1 unit increase in NDVI is associated with an average 2.25°C reduction in surface temperature. Spatial analysis identifies Delhi's Northwest and Southwest regions severe heat hotspot clusters coinciding with vegetation deficit, while protected forest serve as greener corridors and low density, heavily canopied core of Lutyen's Delhi despite having dense build form, marked relatively cooler surface temperature.

Building on this quantitative foundation, the study undertakes a qualitative policy analysis of Delhi's Heat Action Plan (HAP 2025), evaluating it against an established governance framework for urban heat resilience. The analysis finds that while Delhi's 2025 **Heat Action Plan** identifies both heat hotspots and vulnerable populations, it does not sufficiently integrate these dimensions into a **spatially targeted heat-risk framework** that identifies where environmental exposure and socioeconomic vulnerability overlap. This represents an important policy gap, particularly given broader concerns that Heat Action Plans can remain generic and insufficiently responsive to the spatial and socioeconomic dimensions of heat vulnerability.

The study argues that addressing urban heat requires a shift from **city-wide heat management to place-based heat governance**. Integrating satellite-derived heat and vegetation data with socioeconomic vulnerability mapping can enable governments to prioritise cooling interventions, green infrastructure, public services, and adaptation investments where heat risk is greatest—making urban heat resilience not only a climate objective, but also an **environmental justice and public health priority**.