Influence of Building Form on Urban Surface Temperature in Eastleigh, Nairobi

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Background

1. Introduction (or educational background)

- Rapid urbanization in sub-Saharan Africa is intensifying urban heat conditions.
- Eastleigh, Nairobi is a high-density neighborhood with minimal green cover and poor ventilation.
- Impervious surfaces and compact building layouts contribute to elevated Land Surface Temperatures (LST).
- Urban form influences heat retention, but its role in African cities is underexplored.
- Urban morphometrics offer a way to quantify building form impacts on LST using metrics like height, spacing, and orientation

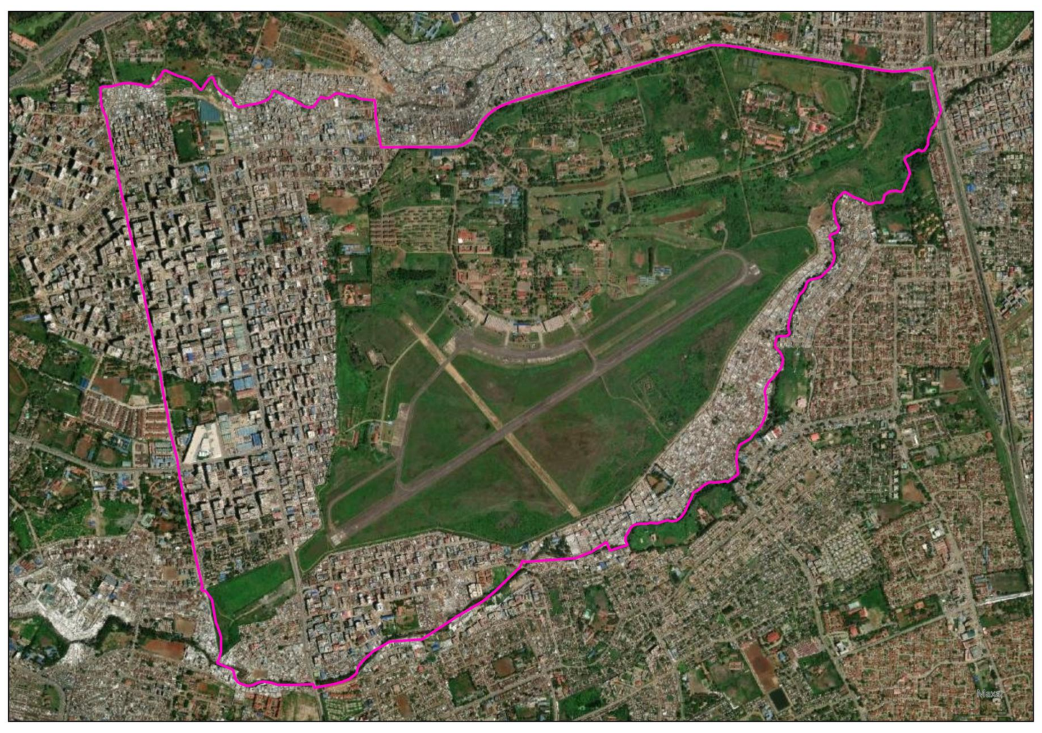

Fig. 1 *Study Area: Eastleigh, Nairobi*

2. Problem statement

- Most LST studies in Nairobi focus on vegetation indices or land cover not building morphology.
- Lack of localized studies on how building form affects LST at neighborhood scale.
- Eastleigh's rapid and irregular development creates complex thermal dynamics.
- High-resolution LST data (e.g., ECOSTRESS) are underutilized in urban heat research in Africa.
- There is limited evidence to guide climate-responsive design in dense urban environments like Eastleigh.

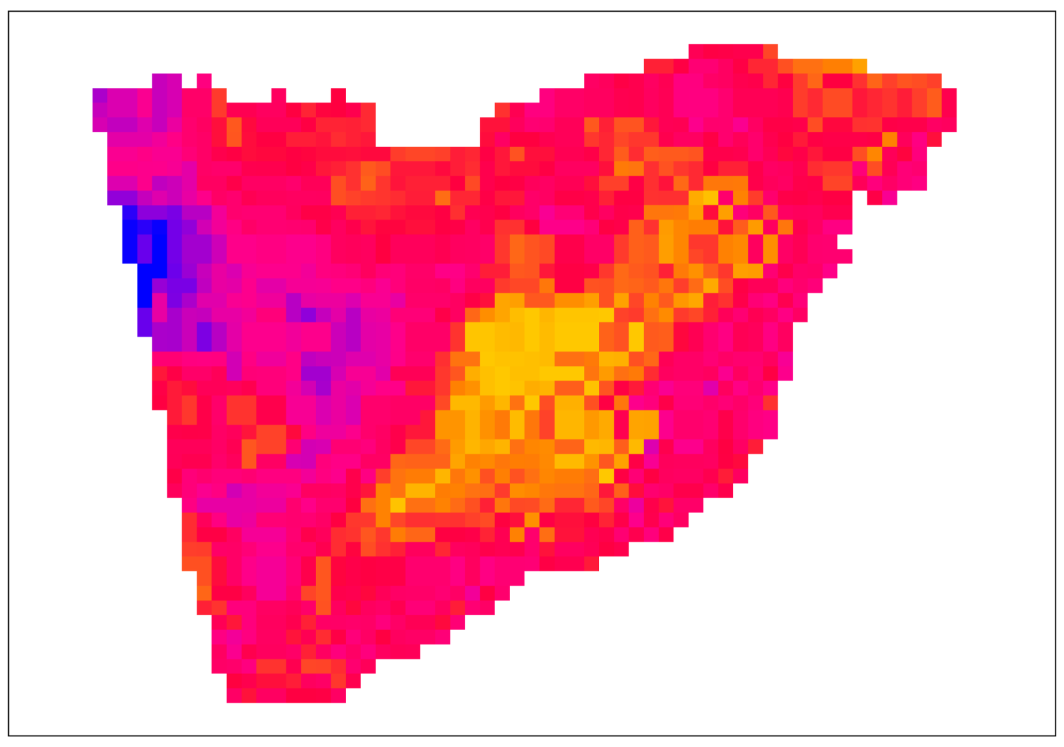

Fig. 2 *ECOSTRESS LST Level-2*

Current Work

1. Objectives

- Identify key Urban Morphometric Metrics (UMMs) driving LST variation.
- Use high-resolution ECOSTRESS data (70 m) and building morphometrics to model LST.
- Analyze the relationship between building morphology and LST in Eastleigh, Nairobi.

2. Methodology

1. **Study Area:** Eastleigh, a high-density urban neighborhood in Nairobi, Kenya.
2. **Thermal Data:** ECOSTRESS LST Level-2 imagery (70 m resolution) from NASA's AppEEARS platform, filtered for clear-sky daytime images (10:00–17:00) during the dry season.
3. **Building Data:** Digitized building footprints extracted from high-resolution imagery; attributes cleaned and standardized in QGIS.
4. **Urban Morphometrics:** Computed 24 Urban Morphometric Metrics (UMMs) using Momepy in Python (e.g., height, orientation, adjacency, spacing).
5. **Spatial Aggregation:** LST and UMMs aggregated to 70 × 70 m grid cells to match ECOSTRESS resolution.
6. **Modeling Approach:** Applied Random Forest Regression (RFR) to predict LST using UMMs as predictors.
7. **Model Evaluation:** Assessed model using R^2, visualized key predictors using Partial Dependence Plots (PDPs).

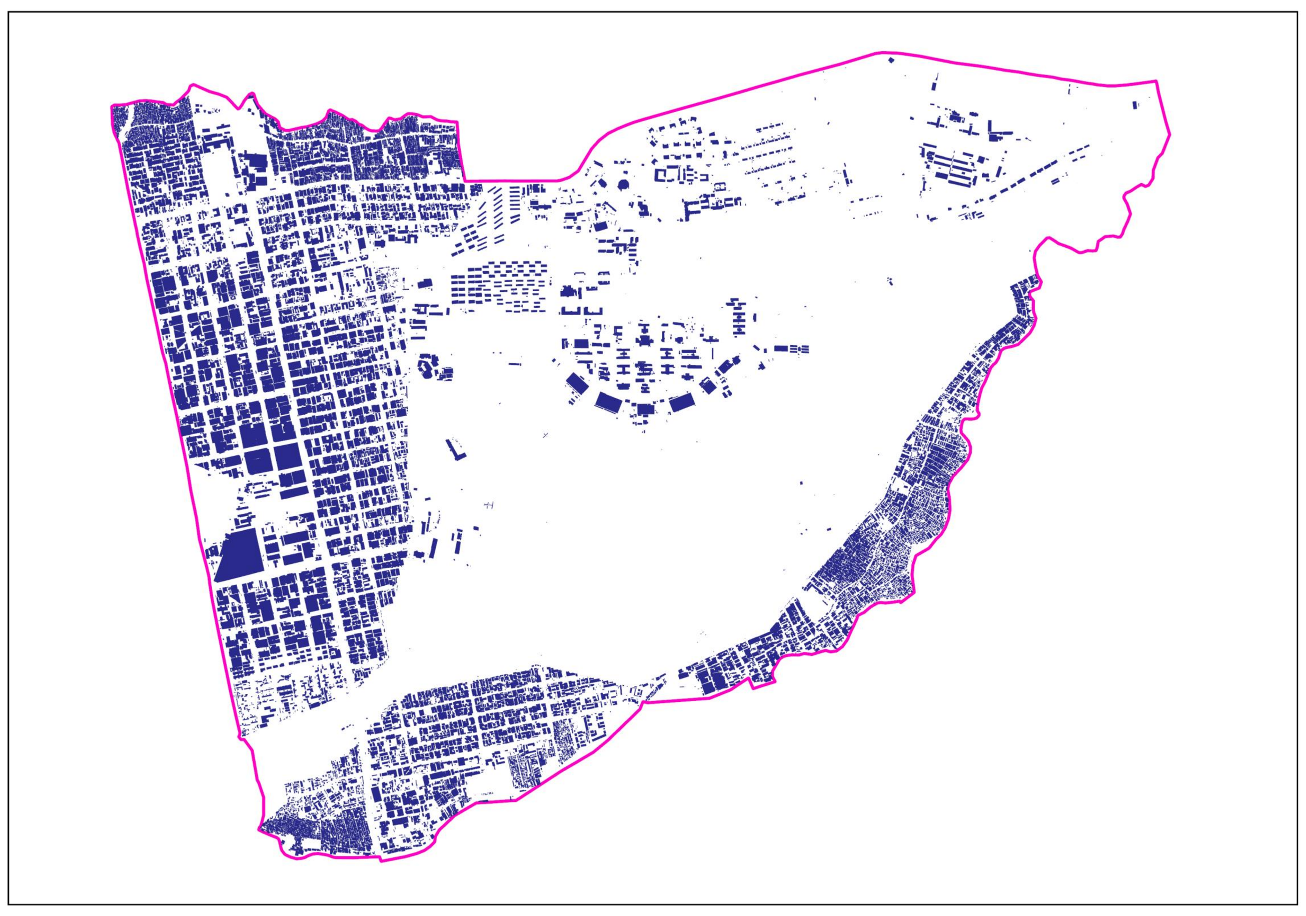

Fig. 3 *Digitized Building Footprints*

3. Results

Conclusion & Expectations

References & Acknowledgment (if needed)

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2. Snigdha Dev Roy, Monika Kuffer, Jiong Wang, Exploring the influence of building morphology on surface temperatures: A multi-city analysis in Europe, Building and Environment, Volume 282,2025,113274,ISSN 0360-1323,https://doi.org/10.1016/j.buildenv.2025.113274.(https://www.sciencedirect.com/science/article/pii/S0360132325007541)

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