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Towards Climate Resilient Affordable Housing in Addis Ababa: An Analysis of Heat Islands

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INTRODUCTION & AIM

- Cities particularly in developing countries are increasingly affected by climate change, including rising urban temperatures.
- Rising Land Surface Temperature (LST) contributes to the intensification of Urban Heat Islands (UHI) (Pal & Ziaul, 2017; Tadesse et al., 2025).
- Intensity of heat islands impacts health (incl. respiratory system and heart) and makes daily life harder for low-income and vulnerable social groups (Bokaie et al., 2016).
- Intensifying temperature increases cooling costs for tenants and landlords (Cohen et al., 2024).
- Understanding the spatiotemporal effect of LULC change and LST is crucial for sustainable and resilient urban development, including monitoring the UHI effect and the development of climate-resilient affordable housing.
- Addis Ababa is also exposed to climate-related vulnerabilities.
- This study explores the effects of spatio-temporal LULC dynamics on LST variability and the intensification of UHI. Besides, the study addresses the implications of UHIs for sustainable and resilient affordable housing development in Addis Ababa.

METHOD

- The study uses Landsat 8 Images.
- Random Forest Machine Learning model is used for LULC classification. ArcGIS Pro, Python, QGIS are used for analysis.

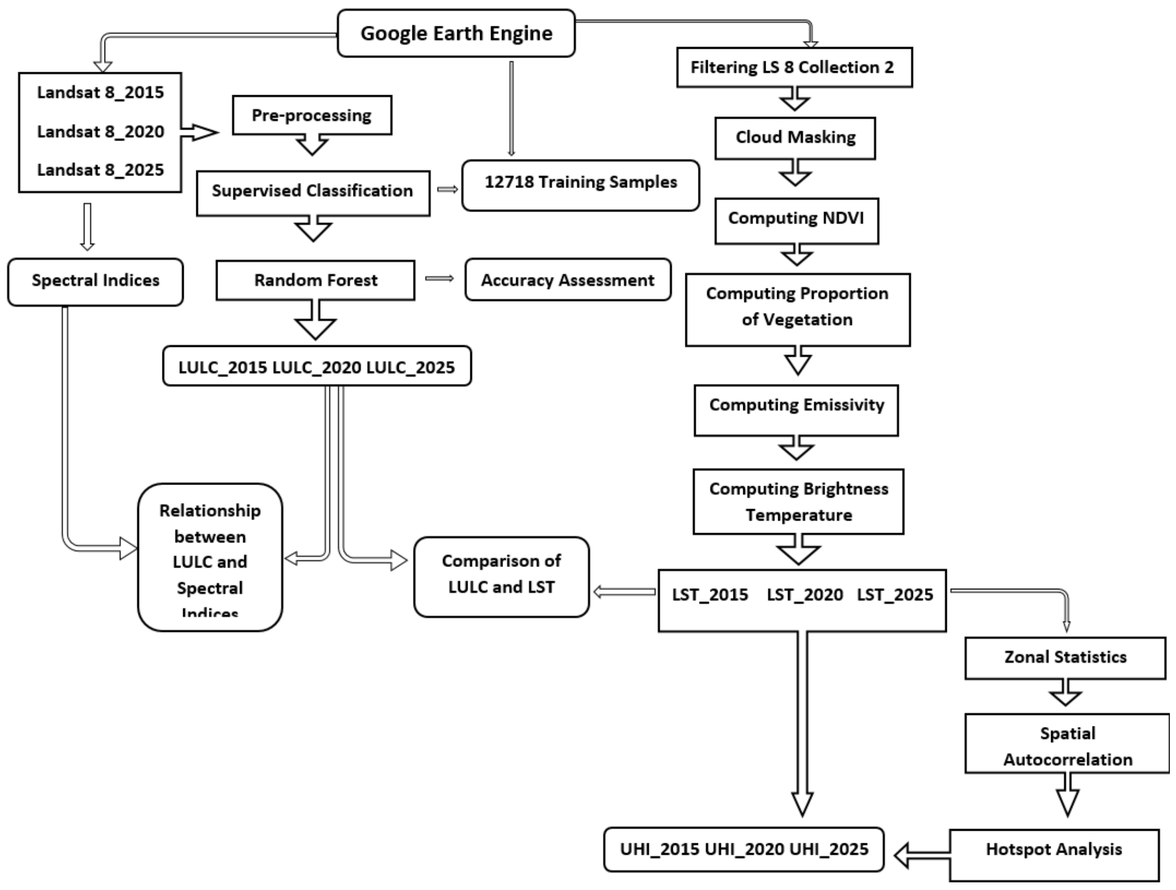

Figure 1: Framework of the methodology

RESULTS & DISCUSSION

- The distribution of heat islands expanded rapidly across the study area from 2015 to 2020 and continued into 2025 (Figure 5)
- Significant LST differences have been observed between the city center and the periphery in the northern part of the city (Figure 4 and 5)
- Rapid urbanization, the construction of Impervious surfaces (such as asphalt roads), and an increase in built-up areas, while vegetation and wetlands have decreased, have contributed to the intensification of UHI (Figure 2)

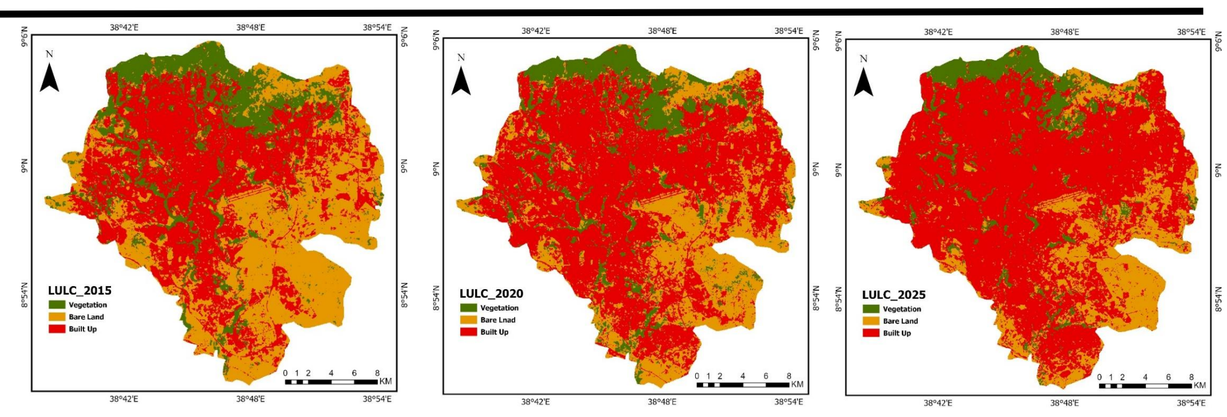

Figure 2: LULC change 2015, 2020, 2025

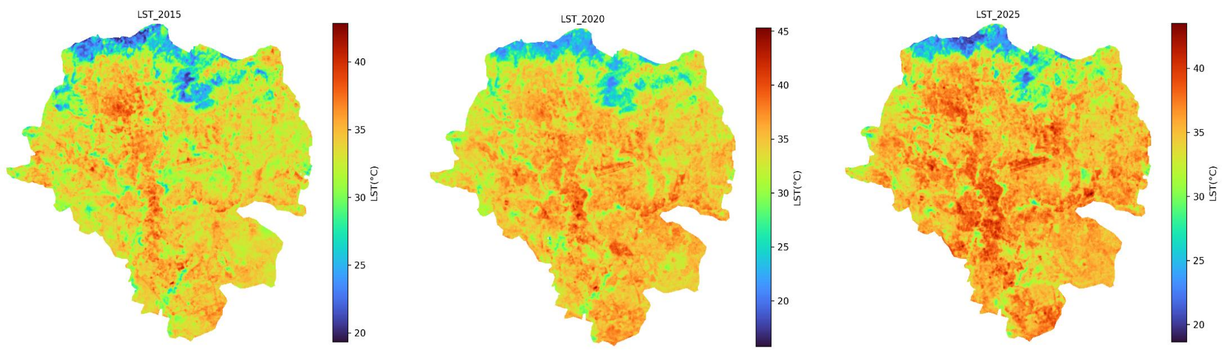

Figure 3: LST 2015, 2020, 2025

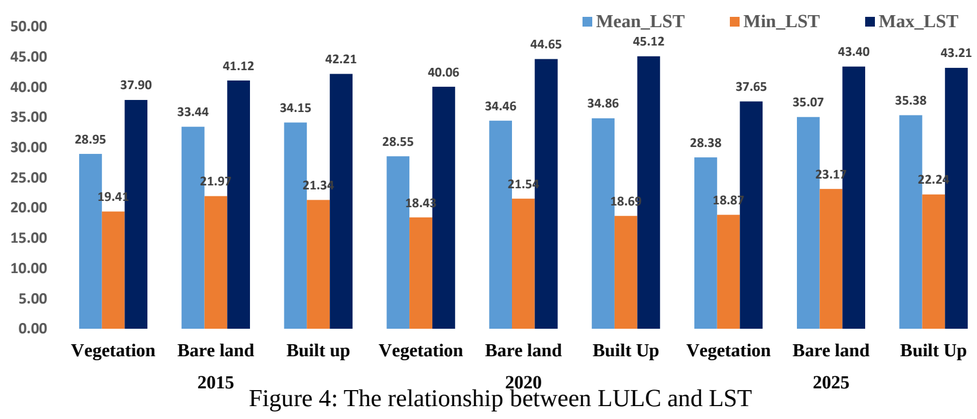

Figure 4: The relationship between LULC and LST

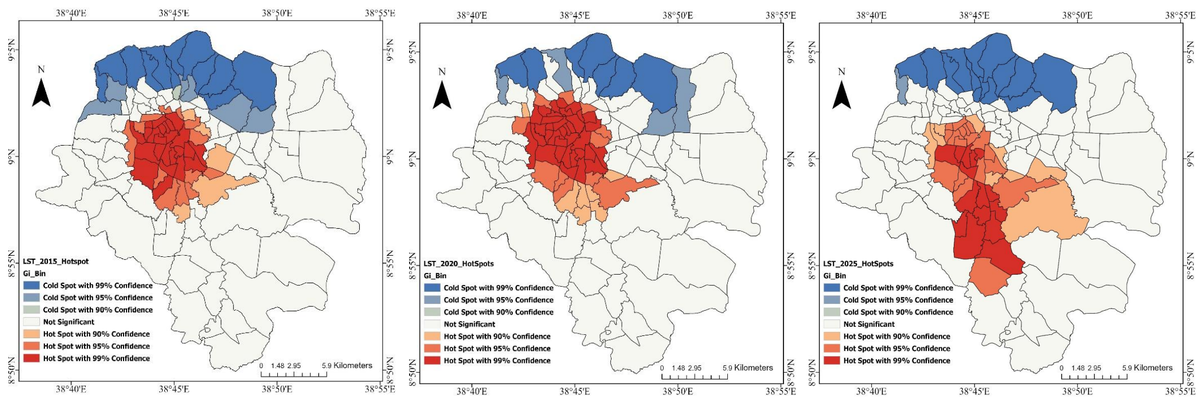

Figure 5: Hotspot analysis LST 2015, 2020, 2025

CONCLUSION/FUTURE WORK

- Spatio-temporal dynamics of LULC influence the spatial variability of LST and the intensification of heat islands.
- Built-up areas have the highest mean LST values, followed by bare land and vegetation land covers. This contributes to the escalation of urban temperature.
- Thus, a need to strengthen mitigation measures in climate-vulnerable areas, plan affordable housing sites, and implement adaptation activities to address the effects of rising heat.
- Future studies will address the socio-economic impact of rising urban temperatures on vulnerable social groups.
- Besides, mitigation measures and their effectiveness in ensuring sustainable, resilient, and affordable housing also warrant greater research focus.

ACKNOWLEDGMENTS/REFERENCES

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