Bachelor of Science (B.Sc.) Thesis

Disproportionate Exposure to Urban Heat Island Intensity across Major Districts of Bangladesh among Different Socio-Demographic Status

Presented by

Muhtamim Haque Tauhid-1804070

Supervised by

Dr. Sheikh Mokhlesur Rahman

Associate Professor

Department of Civil Engineering

Bangladesh University of Engineering and Technology, Dhaka

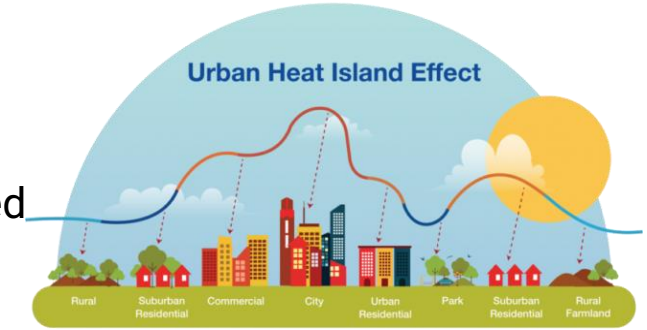
BACKGROUND

Urbanization in Bangladesh:

- Rapid transformation of urban landscapes.
- Replacement of natural environments with dense built-up areas and concrete structures.
- Significant intensification of the **Urban Heat Island (UHI) effect**.

What is Urban Heat Island Effect?

When buildings are closely spaced, heat becomes trapped and unable to escape, leading to increased temperatures that makes cities hotter. This phenomenon is known as urban heat island or UHI.



MOTIVATION

Health Concerns:

- Increased **heat** causing more heat-related illnesses.
- **Vulnerable** groups: elderly, children.

Environmental Impact:

- More **greenhouse gas** emissions and air pollution.
- Environmental degradation.

Social Equity:

- **Marginalized** communities.
- Influencing factors: income, housing, healthcare access.

Urban Resilience:

- **Sustainable** development.
- Improved infrastructure, emergency response, and community engagement.

OBJECTIVES

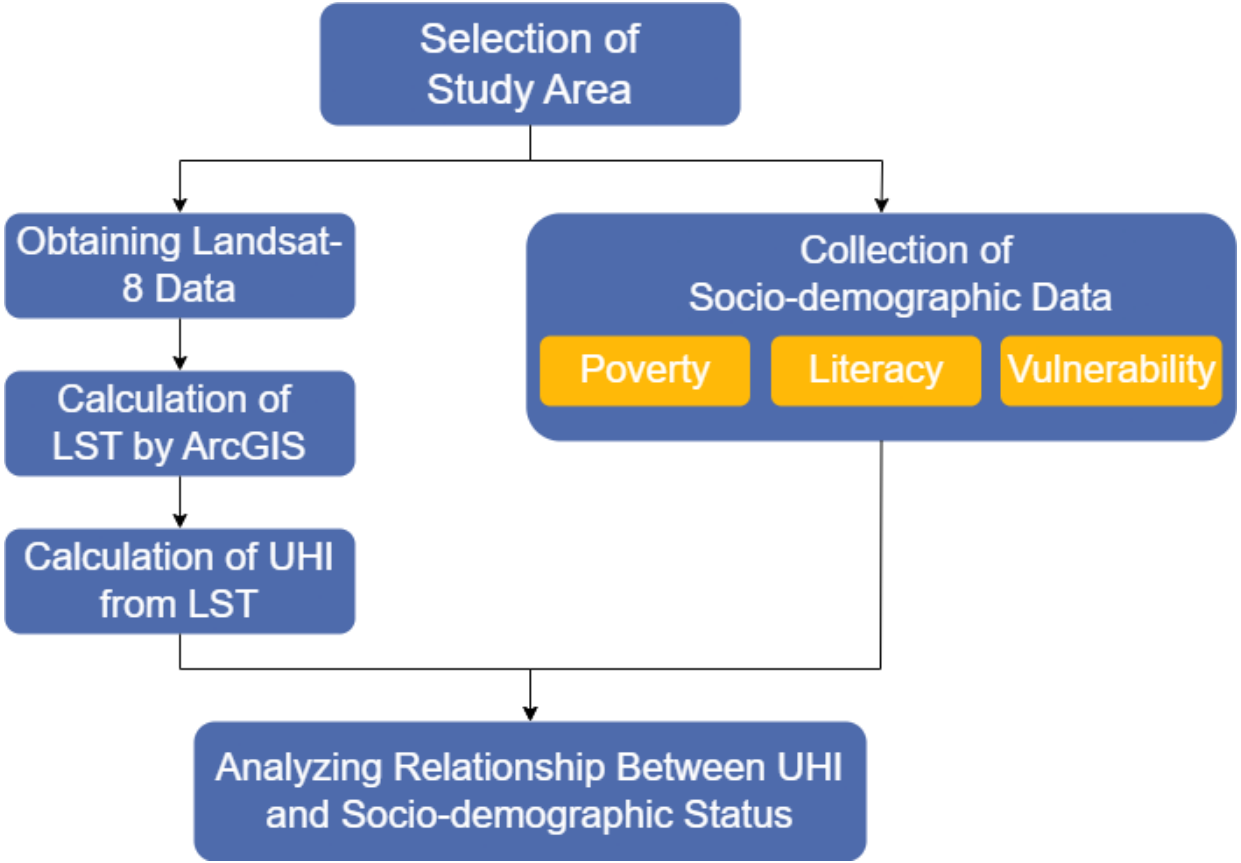
i. Investigate the distribution of Land Surface Temperature (LST) across major districts of Bangladesh,

ii. Investigate the distribution of Urban Heat Island (UHI) intensity across major districts of Bangladesh,

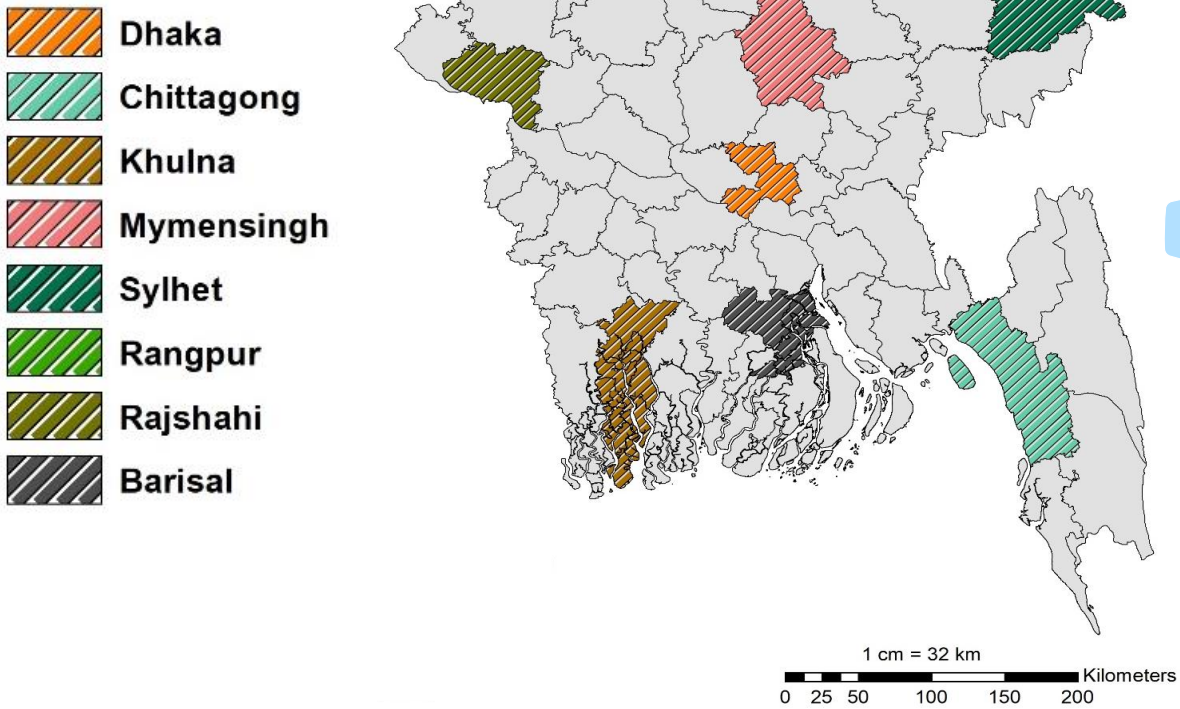
iii. Analyze the relationship between UHI and socio-demographic status (Poverty, Literacy and Vulnerable People).

METHODOLOGY

METHODOLOGICAL OVERVIEW



STUDY AREA



135 Thanas of 8 Major Districts

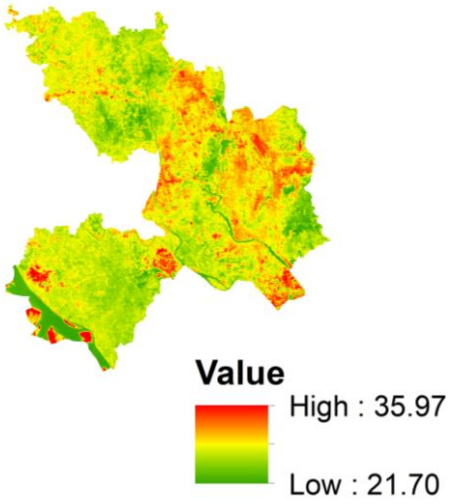
LST (Land Surface Temperature) CALCULATION

- **Landsat-8 Image** to Land Surface Temperature **(LST)** in following **6 Steps**:

1. **TOA** — Conversion to Top of Atmosphere Radiance
2. **BT** — Conversion of Brightness Temperature (BT)
3. **NDVI** — Normalized Difference Vegetation Index
4. **Pv** — Calculation of the proportion of vegetation
5. **LSE** — Calculation of land surface emissivity
6. **LST** — Calculation of land surface temperature

UHI CALCULATION

LST (Dhaka)



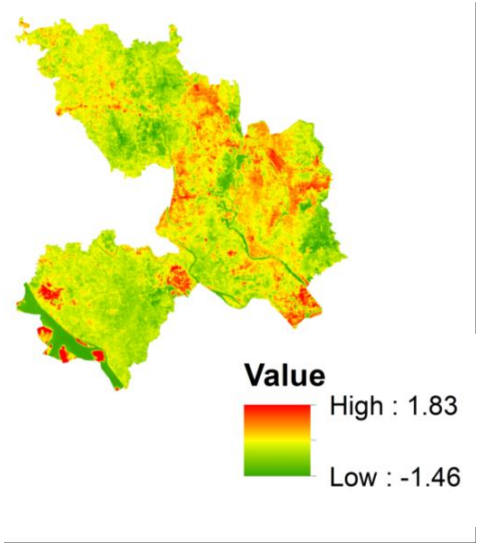
$$UHI = \frac{T - Tm}{Ts}$$

Where, T = LST,

T_m = Mean LST, and

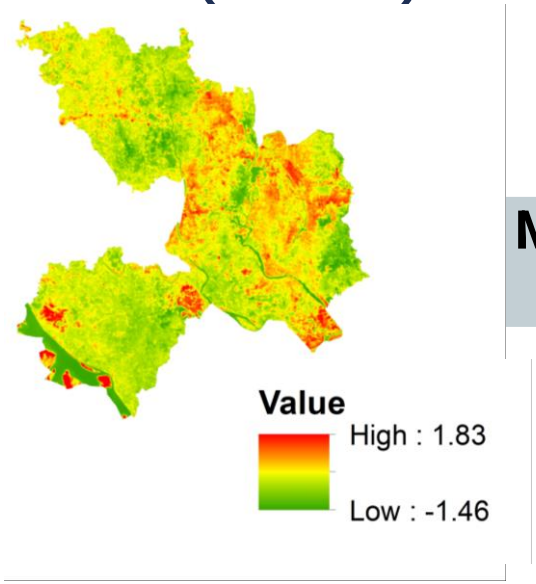
T_s = The standard deviation of LST.

UHI (Dhaka)

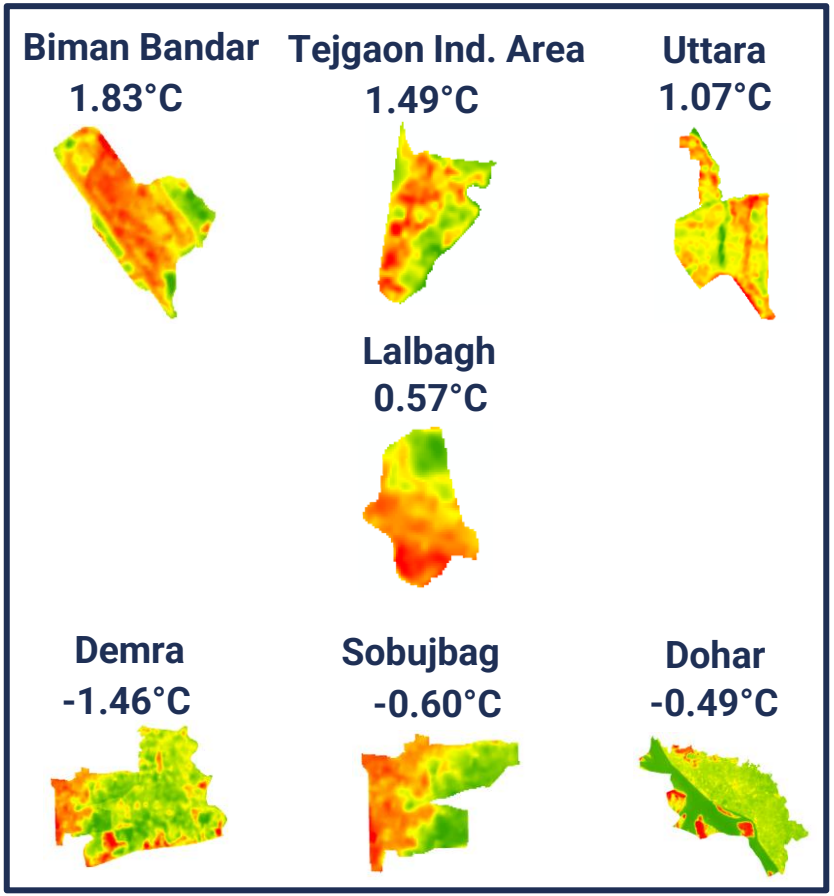


UHI CALCULATION

UHI (Dhaka)



Masking UHI Data



SOCIO DEMOGRAPHIC DATA

LITERACY

- %Literacy Rate (7 Years or Above)

VULNERABLE PEOPLE

- %0-4 and %65+ Aged Population

POVERTY

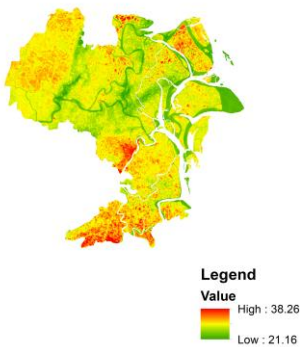
- %Extreme Poor
- %Poor

Source: **Bangladesh Bureau of Statistics (BBS) 2011**

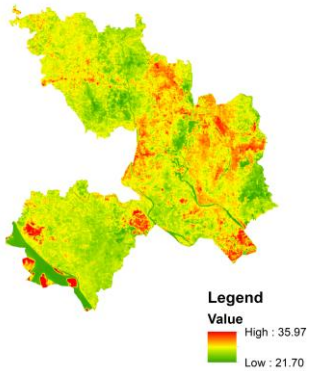
RESULTS

LAND SURFACE TEMPERATURE DISTRIBUTION

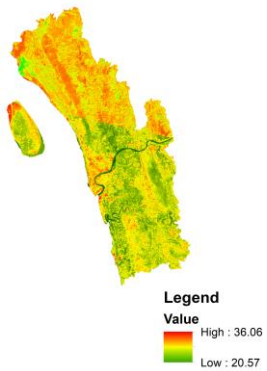
Barisal



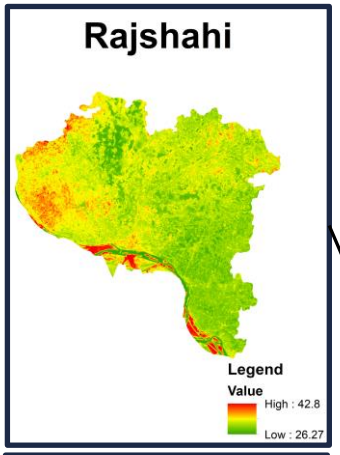
Dhaka



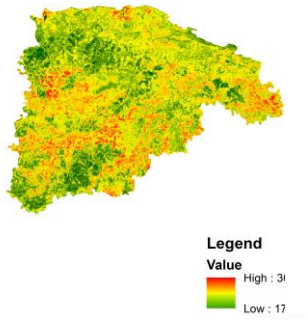
Chittagong



Rajshahi

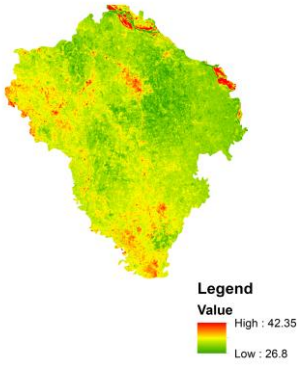


Sylhet

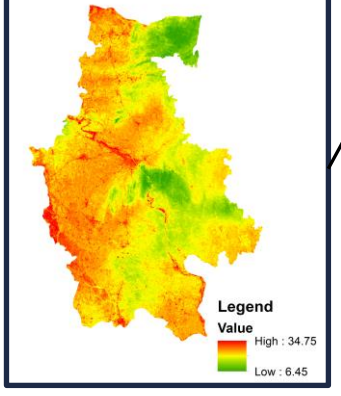


Khulna

Rangpur



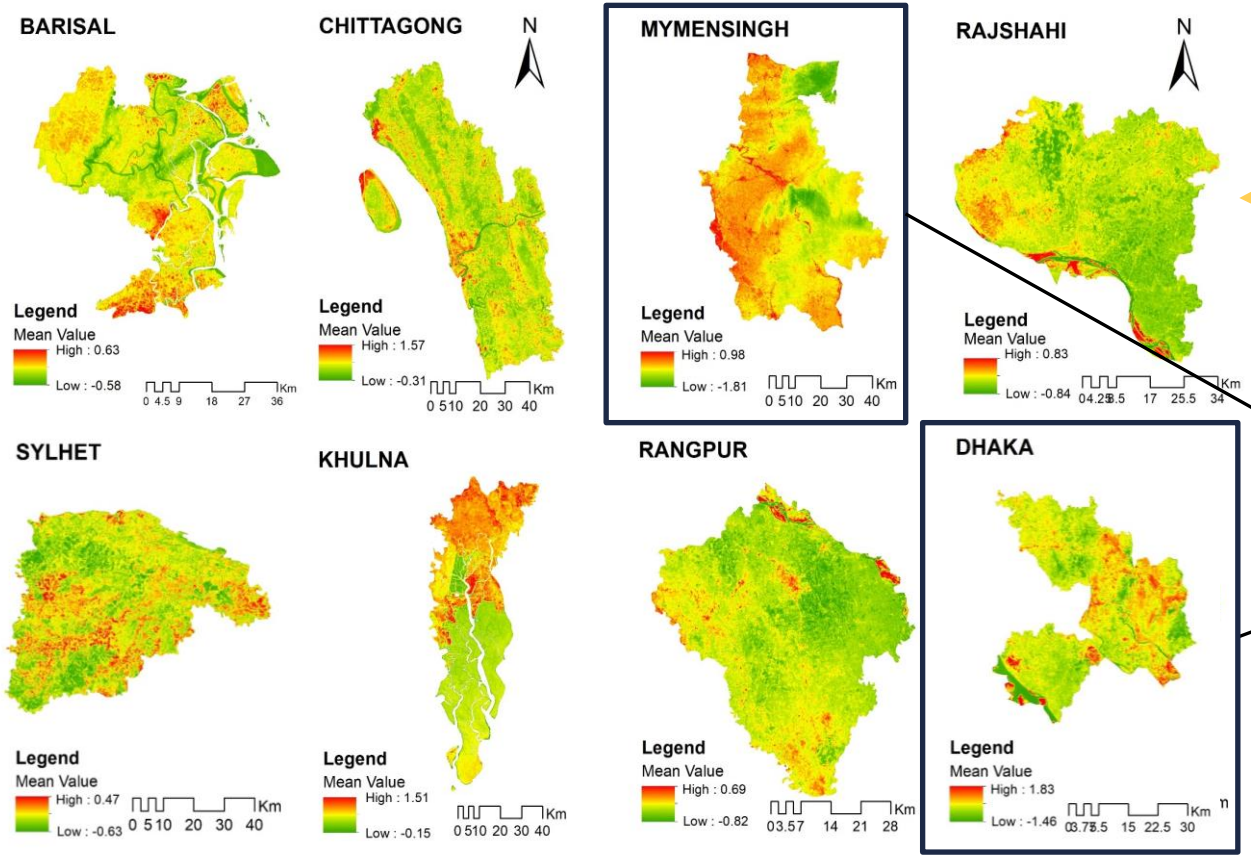
Mymensingh



Highest : 42.8°C

Lowest : 6.45°C

URBAN HEAT ISLAND DISTRIBUTION



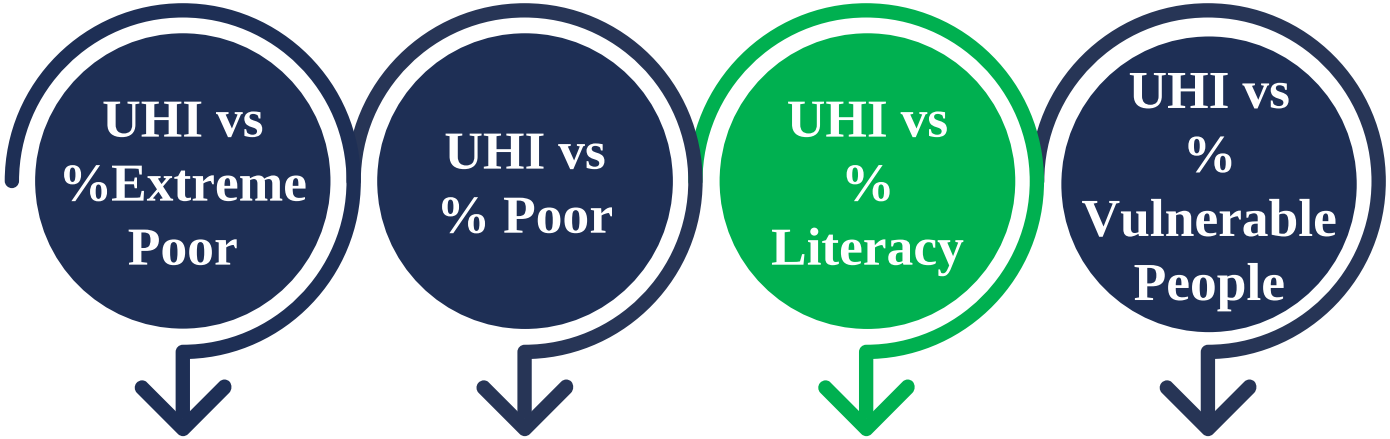
Among **135** thanas,

87 thanas had UHI values higher than 0°C

Lowest : -1.81°C

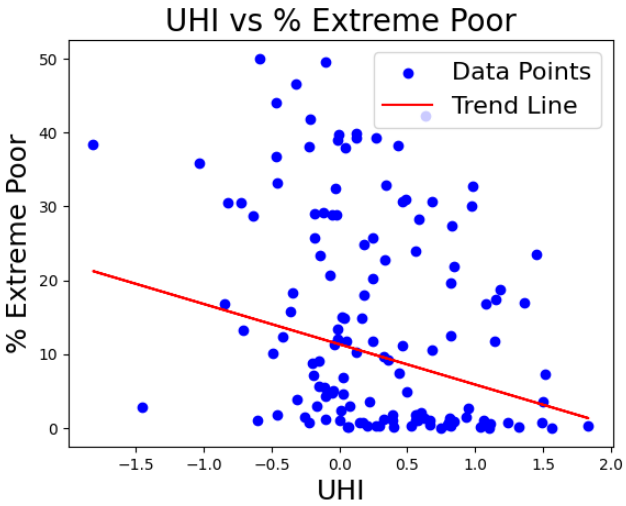
Highest : 1.83°C

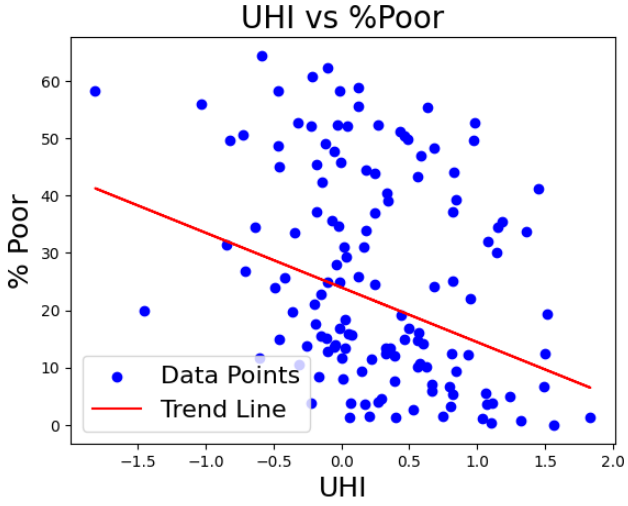
SPEARMAN CORRELATION

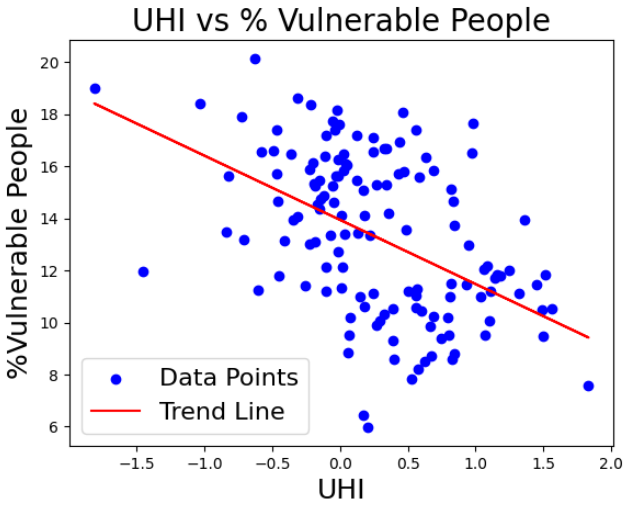


	UHI vs %Extreme Poor	UHI vs % Poor	UHI vs % Literacy	UHI vs % Vulnerable People
1 Correlation Coefficient, r	-0.36	-0.35	0.48	-0.47
2 Strength	Medium	Medium	Medium	Medium
3 P-Value < 0.05	Yes	Yes	Yes	Yes

SCATTER PLOTS WITH TREND LINES

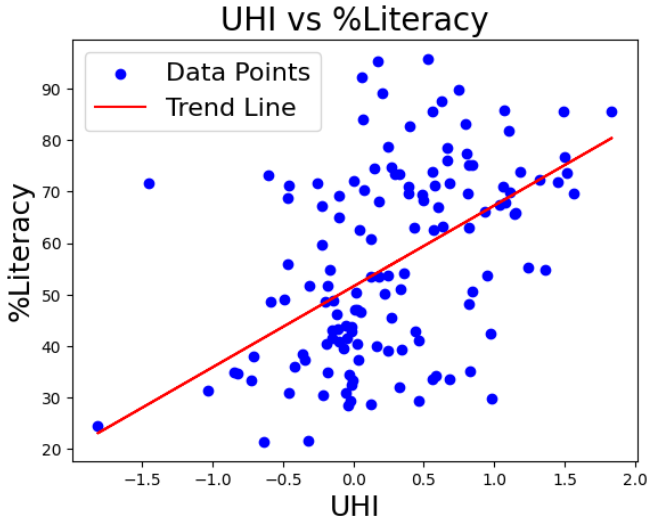






	a	b	c
Kendall's tau	-0.25	-0.24	-0.31
Sen's slope	-5.45	-9.53	-2.46
Trend	Negative	Negative	Negative

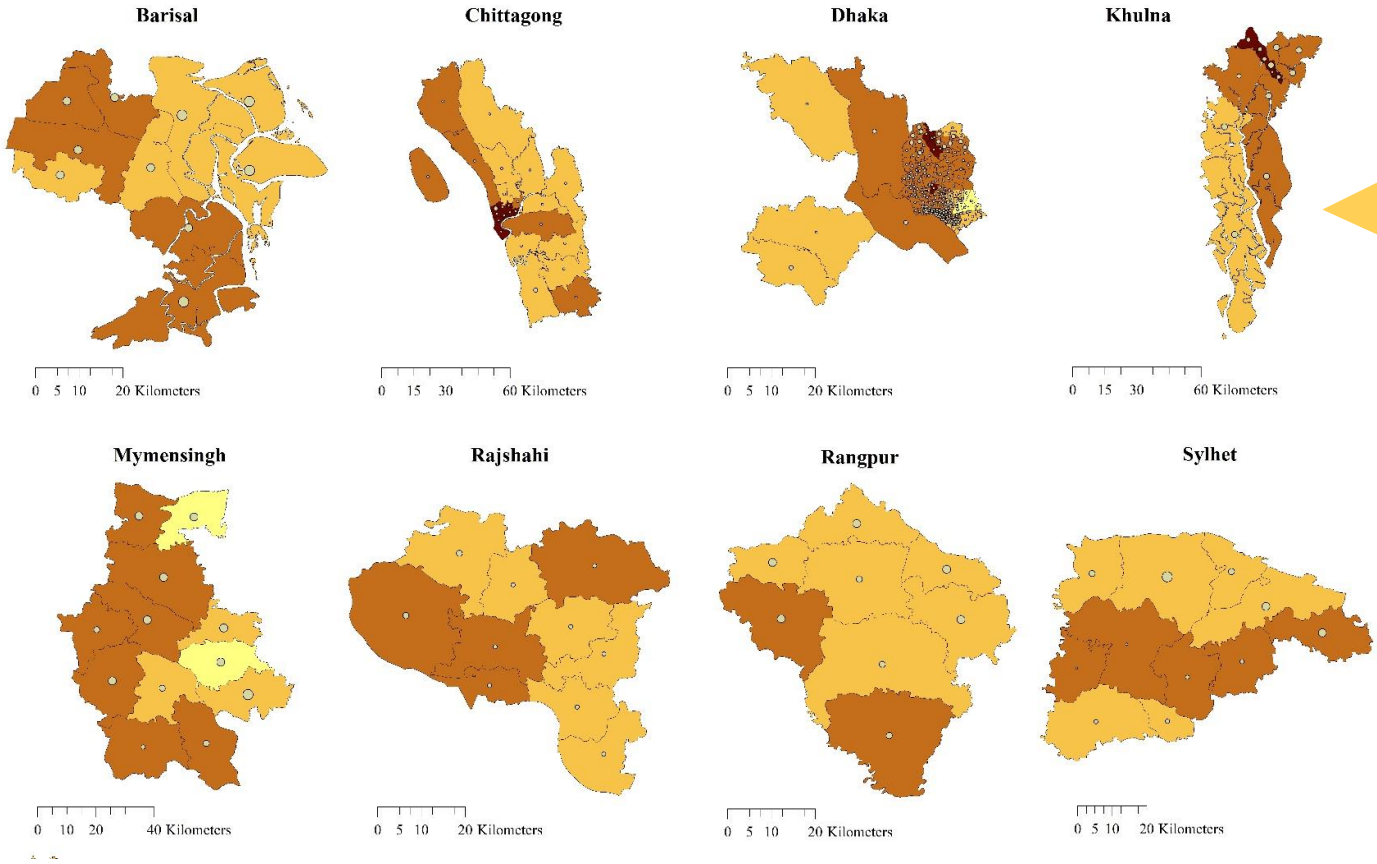
SCATTER PLOTS WITH TREND LINES



d

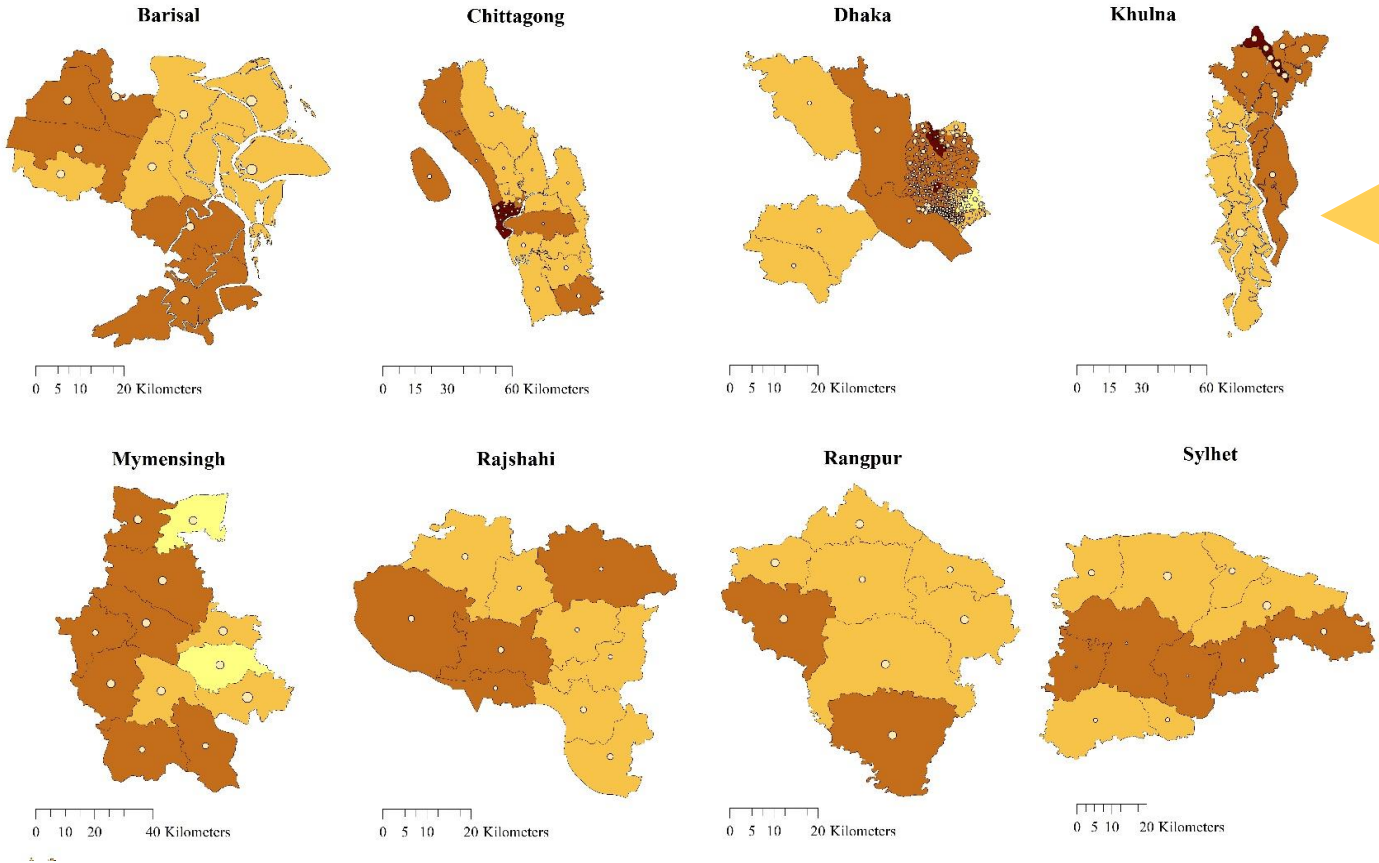
Kendall's tau	**0.32**
Sen's slope	**15.71**
Trend	**Positive**

UHI DISTRIBUTION BY SOCIO-DEMOGRAPHIC STATUS



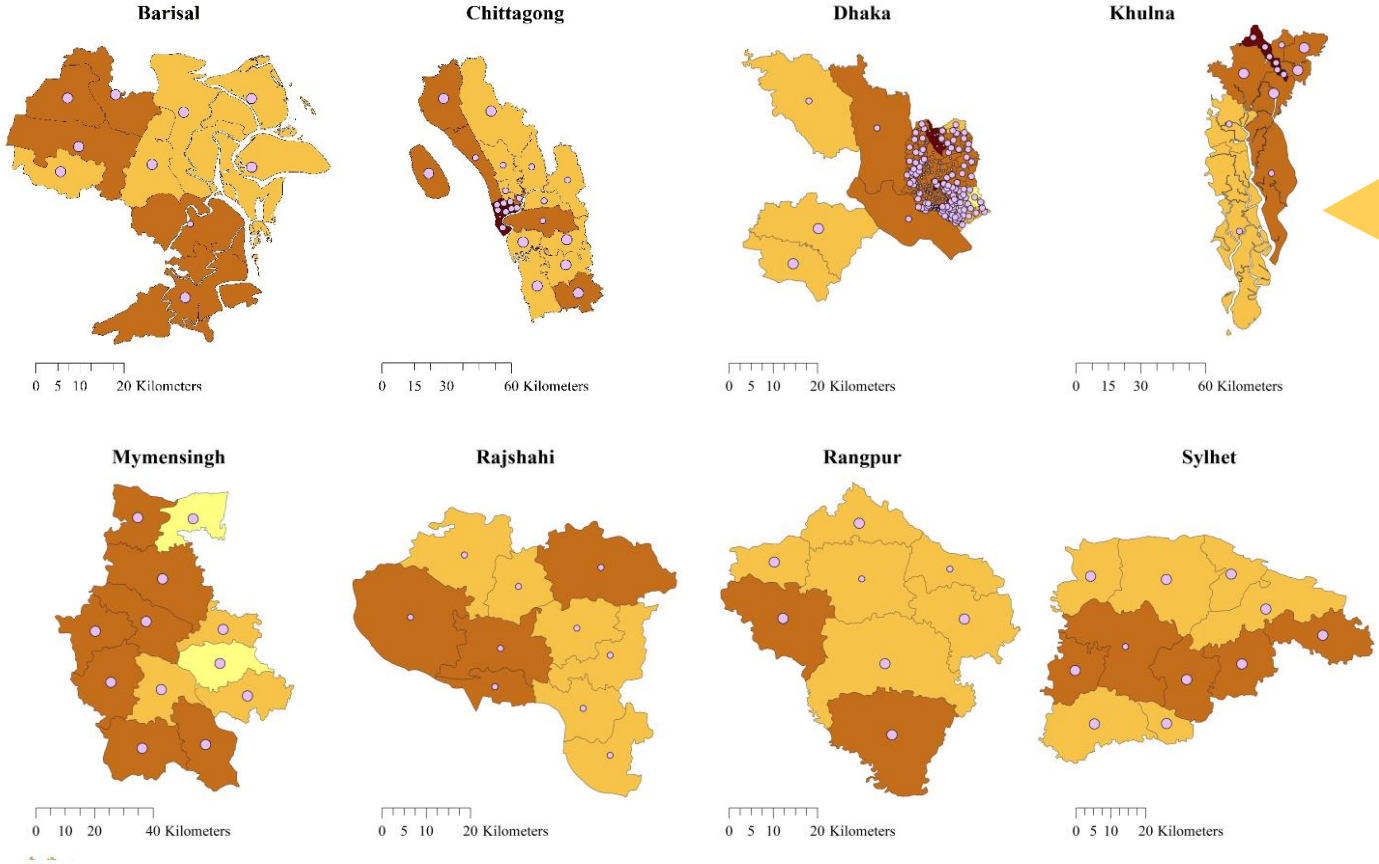
63 out of **87** UHI-affected areas had below-average percentages (17.6%) of **extremely poor individuals.**

UHI DISTRIBUTION BY SOCIO-DEMOGRAPHIC STATUS



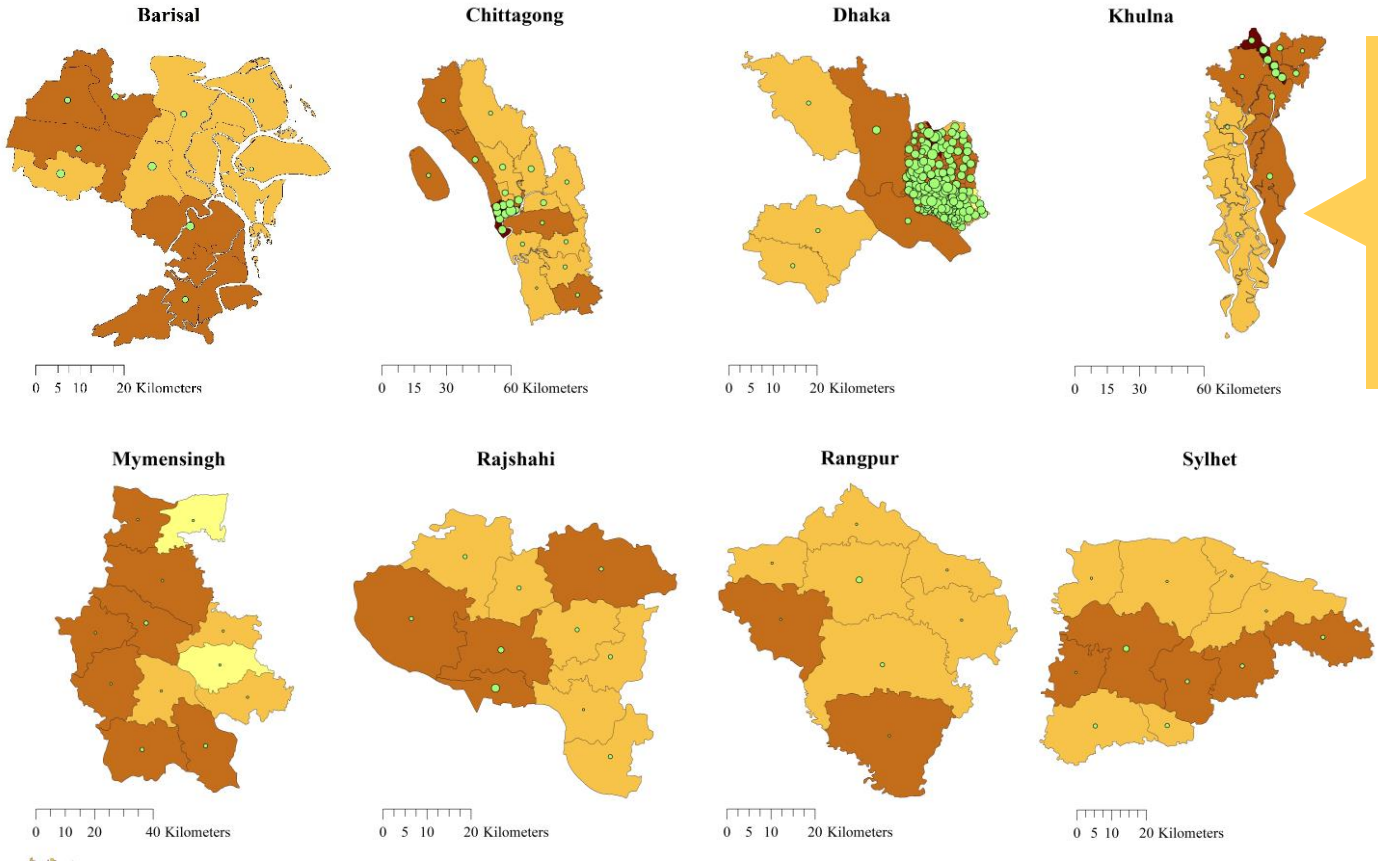
60 out of 87 UHI-affected areas had below-average percentages (31.5%) of **poor individuals.**

UHI DISTRIBUTION BY SOCIO-DEMOGRAPHIC STATUS



57 out of 87 UHI-affected areas had below-average percentages (13.73%) of **vulnerable people.**

UHI DISTRIBUTION BY SOCIO-DEMOGRAPHIC STATUS



62 out of 87 UHI-affected areas had above-average percentages (51.8%) of **literate individuals.**

CONCLUSION

1. Analyzed UHI effect in **135 thanas** of Bangladesh.

2. UHI >0°C in **87** thanas, highlighting significant urban heat issues.

3. **Negative Trend:**

Higher UHI intensity locations tend to have **lower** poverty rates and **fewer** vulnerable individuals.

4. **Positive Trend:**

Higher UHI intensity locations tend to have **higher** proportion of literate persons.

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THANK YOU

Any Question?