Urban Green Space Mapping for Heat Reduction and Climate Resilience

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INTRODUCTION

- This project focuses on addressing Urban Heat Islands (UHIs) in Khulna, Bangladesh, caused by rapid urbanization and green space degradation.
- Challenges include increased local temperatures, higher energy demands, and heat-related health risks.
- By mapping and evaluating Khulna's urban green spaces, the project aims to mitigate heat stress and enhance climate resilience.
- Situated near the Sundarban mangrove forest, Khulna faces fragmented green spaces, reducing their ability to counteract extreme heat effectively.

Objectives

1 **Green Space Mapping**

Identify and map green spaces.

2 **Spatial Distribution**

Analyze green space locations.

3 **Temperature Relationship**

Assess impact of green spaces on heat.

4 **New Green Spaces**

Identify areas for future development.

Study Area - Khulna

[latitude 22.8456° N and longitude 89.5403° E]

Urban Areas

- Dense construction with limited greenery.
- High Urban Heat Island (UHI) effects.

Peripheral Areas

- Semi-natural landscapes with wetlands and fields.
- Flexibility for afforestation and green expansion.

Sundarbans

- Largest mangrove forest; UNESCO World Heritage Site.
- Natural climate buffer Shields against cyclones surges.
- Key carbon storage, aiding climate change mitigation.

Literature Review

Role of Urban Green Spaces (UGS)	Mitigate UHI and lower LST.	Provide ecosystem services.
Findings from Other Studies	Kolkata: 8.62% reduction in green spaces correlated with higher LST.	Khulna: 2°C LST rise over five years due to urbanization.
Tools & Techniques	NDVI, NDBI for green space and heat mapping.	Geospatial frameworks for sustainable planning.

Methodology

1

Data Collection

Satellite imagery provides wide-area coverage, while field surveys collect local data for ground truthing.

2

Data Processing

Geospatial analysis using GIS software is used to process and analyze data.

3

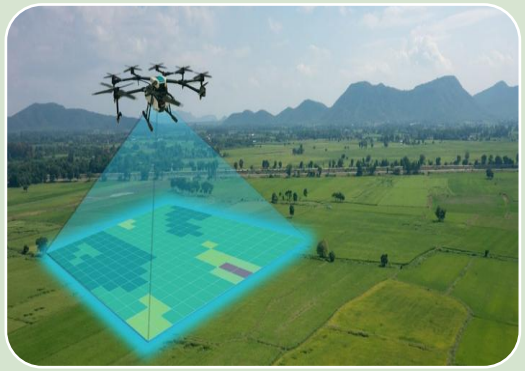
Heat Reduction and Climate Resilience Identification

Urban heat island mapping helps identify hotspots, while suitability analysis helps to plan green space expansion.

Data Collection and Integration

Satellite Imagery

High-resolution imagery from Landsat or Sentinel. Used for assessing land cover and green space distribution



Field Surveys

Ground trothing to verify satellite data. Captures temperature variations across vegetation types.

Local Climate Data

Gathered from meteorological stations. Analyzes urban heat island effects through temperature and humidity trends

Data Processing and Analysis

1

Geospatial Analysis

Using GIS software such as ArcGIS or QGIS, to identify and categorize quantify green space coverage and calculate metrics such as green space density and connectivity.

2

Heat Mapping

Thermal infrared data from satellite imagery will be used to create heat maps, visualizing the spatial distribution of urban heat hotspots.

3

Overlay Analysis

GIS tools will allow for overlay analysis, comparing the proximity of green spaces to urban heat zones and mangrove forests.

Heat Reduction and Climate Resilience Identification

Urban Heat Island Mapping

1

Identifies UHI hotspots using thermal infrared imagery, correlating heat stress with green space availability.

Climate Resilience Indicators

3

Assesses mangroves and urban green spaces mitigate climate change impacts, buffers, floodwater absorbers, shade providers, and heat island effect reducers..

2

Potential Green Space Expansion

Using GIS suitability analysis, the study pinpoints areas suitable for green space expansion, considering factors like land use, slope, urban proximity, and connectivity to existing green spaces.

Software and Tools

ArcGIS

- Suitability analysis to identify areas for green space expansion
- Advanced GIS software for spatial analysis and UHI zones.

ENVI

- Remote sensing software for NDVI calculation and heat mapping.
- Thermal infrared imagery analysis for UHI mapping.

Python/R

- Statistical analysis of temperature and vegetation correlations.
- Automation of geospatial data processing and visualization.

Expected Outcomes

Green Space Map

Comprehensive spatial data.

UHI Hotspots

Identify areas with high heat stress.

Green Infrastructure

Strategic recommendations for expansion.

Policy Guidance

Integrating green spaces into urban planning.

Timeline

Phase	Duration	Activities
Phase 1: Data Collection	2 months	Satellite imagery, field surveys, local climate data gathering
Phase 2: Data Processing	3 months	GIS mapping, heat mapping, NDVI analysis
Phase 3: Analysis & Reporting	2 months	Identification of UHI hotspots, green space analysis, report preparation
Phase 4: Policy Recommendations	1 months	Finalization of report, policy recommendation drafting

Budget Estimation

Category	Details	Estimated Cost (TK)
1. Data preprocessing	Satellite Imagery (Landsat/Sentinel): Free Climate Data: Free or minimal collaboration costs	Free (Open source)
2. Software Licenses	Open-source tools: QGIS, Python/R, Google Earth Engine	Free (Open source)
3. Field Surveys	Transportation: 55,000 tk (approximate) Survey Equipment rent : 35,000 tk Field survey (honorarium) : 50,000 tk	1,40,000
4. Research Personnel	Research Assistants: TADA GIS/Remote Sensing Expert: Faculty support	45,000

Conclusion

Key Findings

Green spaces effectively reduce Urban Heat Islands (UHIs).
Mangroves and urban greenery play a crucial role in mitigating heat stress and climate impacts.

Recommendations

Increase urban green spaces and afforestation.
Integrate mangrove ecosystems
into urban planning for climate resilience.

Impact

Improved thermal comfort and reduced heat stress.
Enhanced flood mitigation and sustainable urban development.

THANK YOU