FIG Working Week 2024
19-24 May
Accra, Ghana
Your World, Our World: Resilient Environment and Sustainable Resource Management for All

Presented at the FIG Working Week 2024,
19-24 May 2024 in Accra, Ghana

Urbanization Effects on Land Surface Temperature in Soba Local Government Area, Kaduna State, Nigeria: A Spatio-Temporal Analysis

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PRESENTATION OUTLINE

INTRODUCTION

MATERIALS AND METHODS

RESULTS AND ANALYSES

CONCLUSION

INTRODUCTION

Urbanization, driven by human interaction with the environment, alters land use.

Likewise, urbanization leads to Urban Heat Islands due to climate and land use changes.

UHI intensity correlates with urbanization

Impact of urbanization on urban LST variance can be assessed using geospatial tools

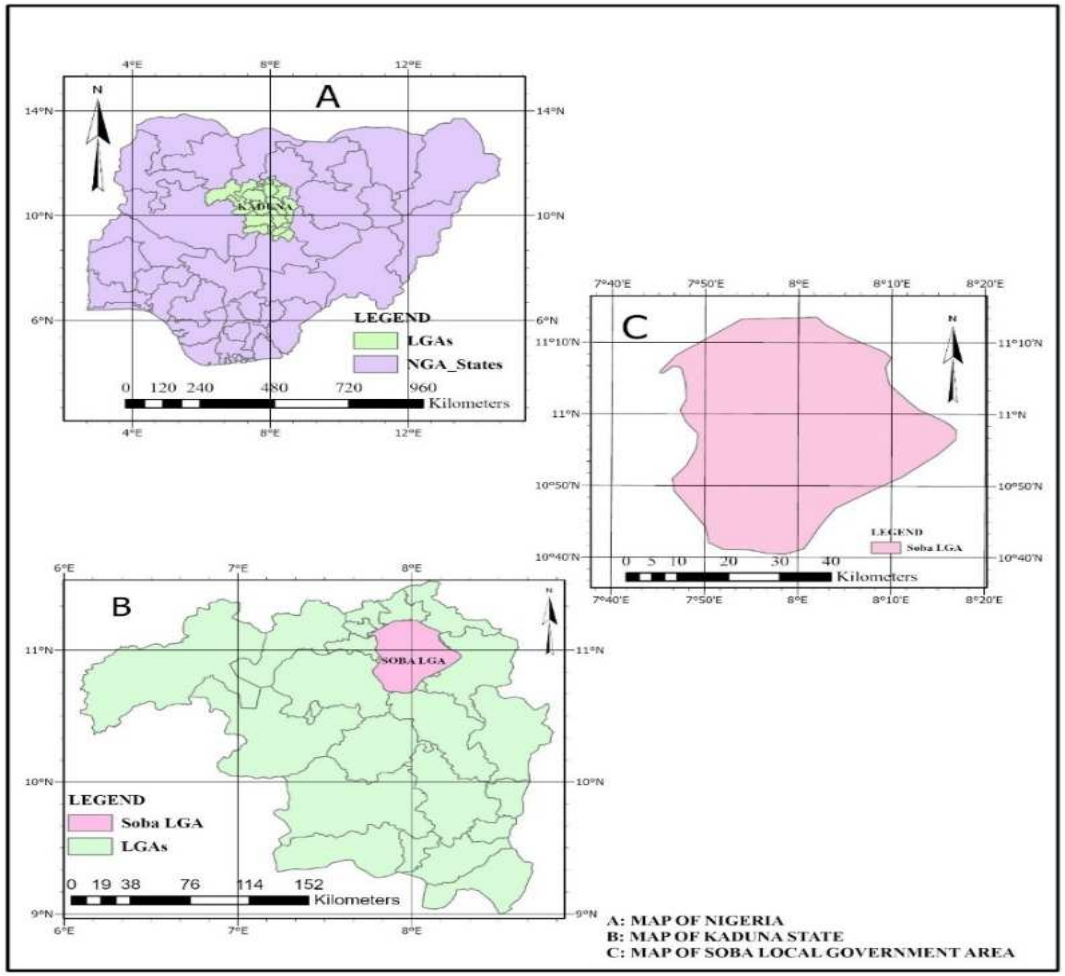
In this study, geospatial tools are employed to analyze the impact of urbanization on urban land surface temperature variance in the study area.

INTRODUCTION cont.

The study area Soba LGA is in Kaduna State, Nigeria.

It is between 10° 20' 06" to 10° 59' 60" N & 8° 03' 32" to 8° 30' 15" E

It covers an area of 2,234 km²



MATERIALS AND METHODS

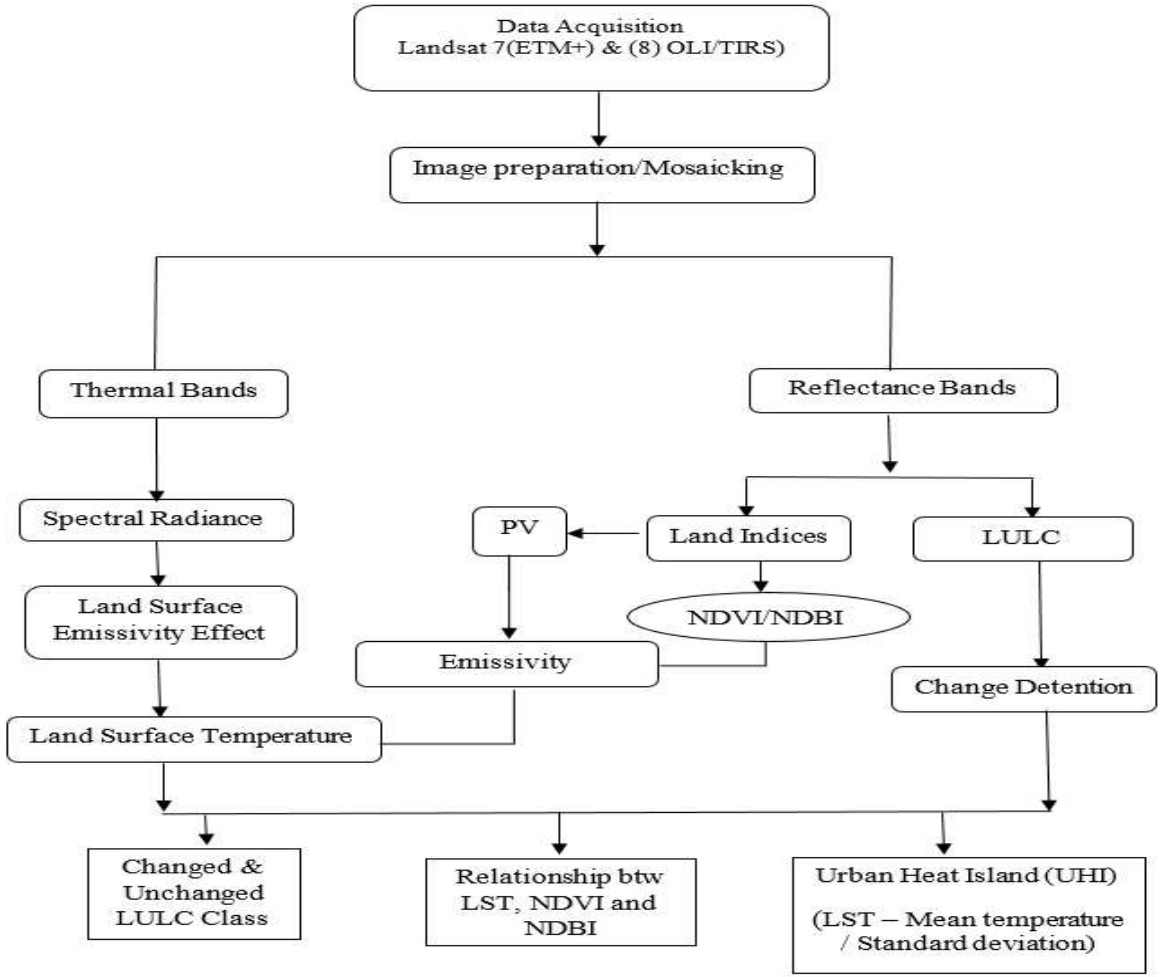
Table 1: Landsat Data Characteristics

Data Type	Path/Row	Year	Resolution (m)	Date acquired by Satellite	Date Obtained
Landsat 7 TM	P189R052	2001	30	11th Dec. 2001	21st April 2022
Landsat 7 ETM+	P189R052	2011	30	21st Nov. 2011	21st April 2022
Landsat 8 OLI	P189R052	2021	30	11th Nov. 2021	21st April 2022

Table 2: Software and their uses

Software	Uses
ArcGIS v10.7.1	For land cover classification, accuracy assessment, and the final product's visualization.
Envi 5.3	To sub-set the images and create the study's land use/land cover classes and accuracy assessment
Math Type	For mathematical formulas
Microsoft Office	This was used for the write-up and the presentation of the research

MATERIALS AND METHODS



MATERIALS AND METHODS

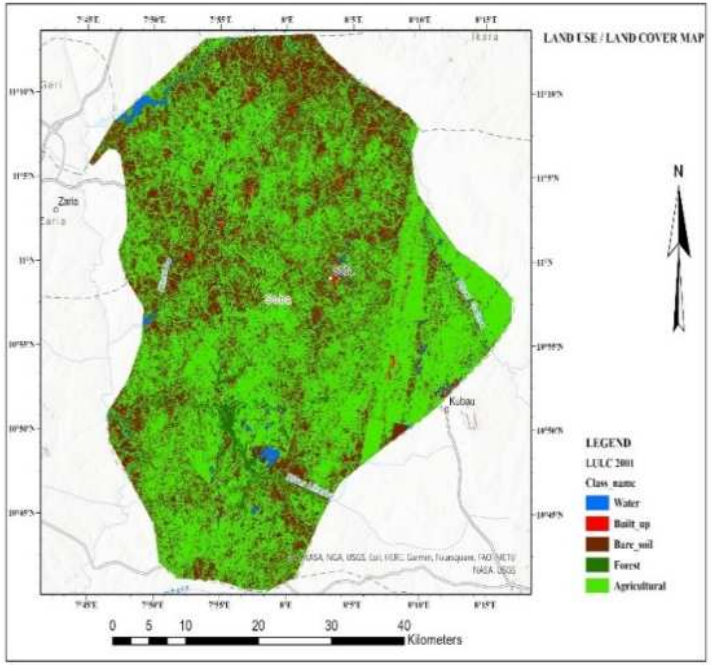
- Land cover classification
- Derivation of NDVI and NDBI
- Land Surface Temperature (LST) retrieval
- Urban Heat Island Estimation
- Growth rate

Table 3

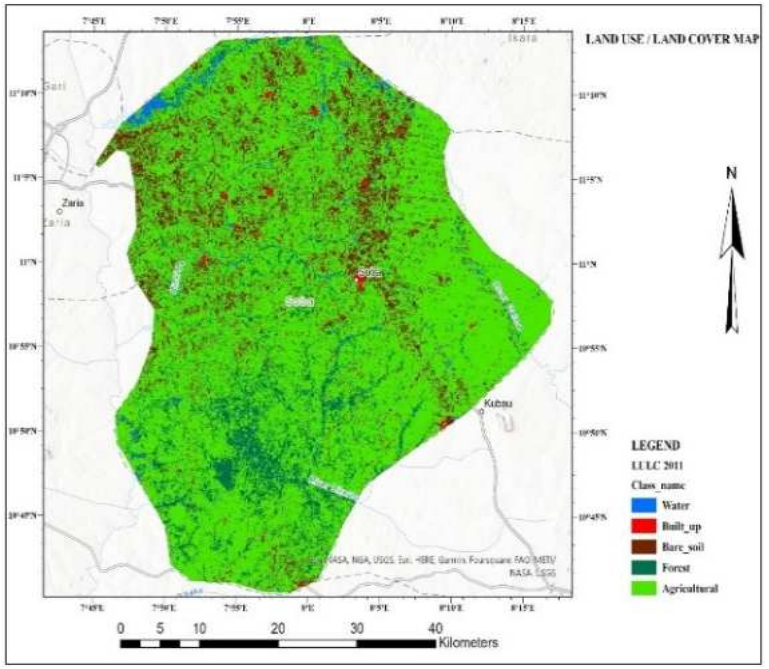
Code	Land use / Landover	Description
1	Agricultural land	Lands used for farming (Plantation, Cropland orchard)
2	Built-up land	Lands used for residential, industrial, commercial, etc.
3	Grassland / Forest cover	Lands covered with natural vegetation (plant species)
4	Bare surfaces	Lands devoid of vegetation exposed soil
5	Water bodies	Areas with lakes, rivers, and streams.

RESULTS AND ANALYSES

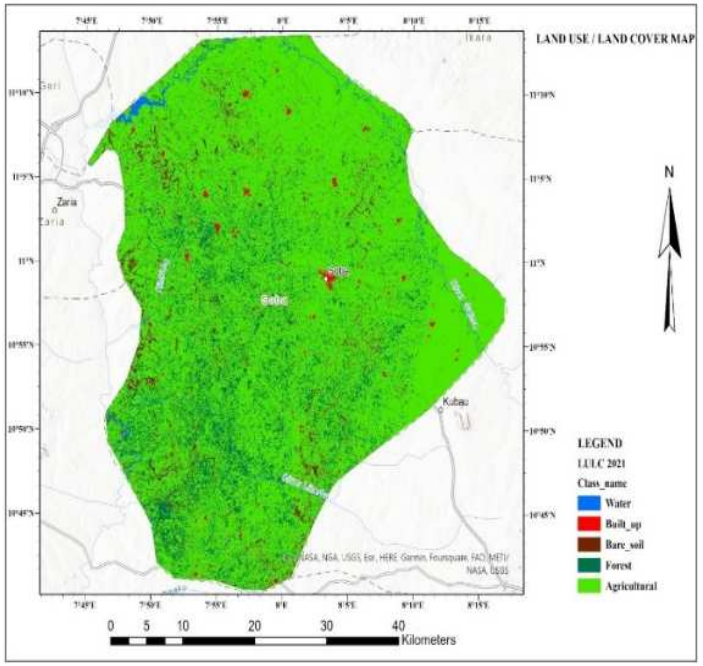
Spatial Pattern of Land/Use and Land/Cover



LULC map 2001



LULC map 2011



LULC map 2021

RESULTS AND ANALYSES

Table 4

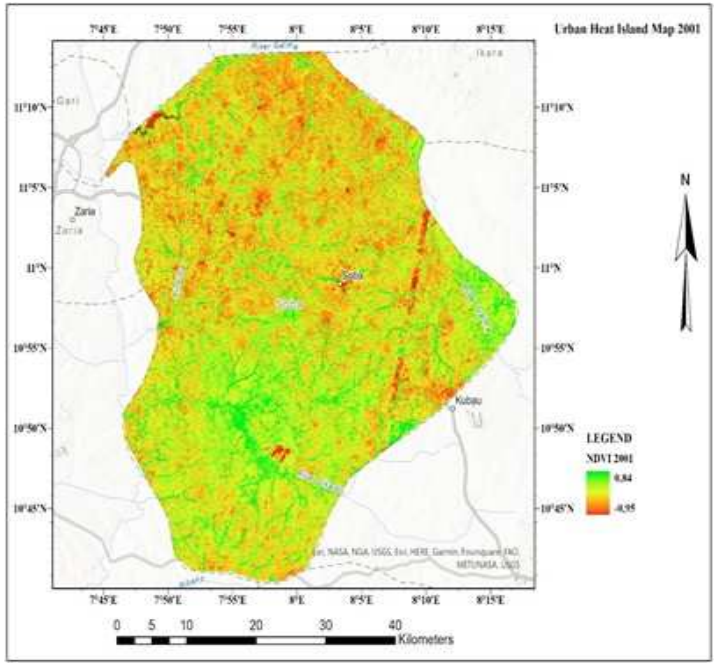
Class name	2001 (Km²)	%	2011 (Km²)	%	2021 (Km²)	%
Water	23.517	1.055	30.492	1.368	24.807	1.113
Built up	16.375	0.734	16.178	0.726	17.612	0.790
Bare soil	719.598	32.276	286.571	12.853	94.989	4.260
Forest	51.373	2.304	205.339	9.210	258.980	11.616
Agricultural land	1418.687	63.631	1690.992	75.844	1833.191	82.221
Total	**2229.550**	**100.000**	**2229.573**	**100.000**	**2229.579**	**100.000**

Table 5

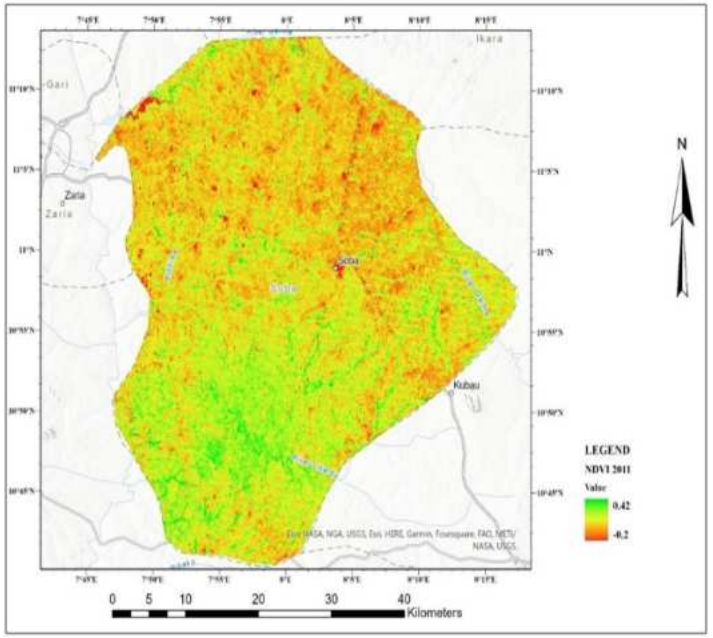
Class name	2001 (Ha)	2011 (Ha)	2021 (Ha)	Diff. 2001-2011	Diff. 2001-2021
Water	2351.739	3049.226	2480.658	697.487	128.919
Built up	1637.480	1617.837	1761.249	-19.643	123.768
Bare soil	71959.841	28657.107	9498.925	-43302.734	-62460.916
Forest	5137.269	20533.920	25897.962	15396.651	20760.693
Agricultural land	141868.653	169099.166	183319.074	27230.513	41450.421

RESULTS AND ANALYSES

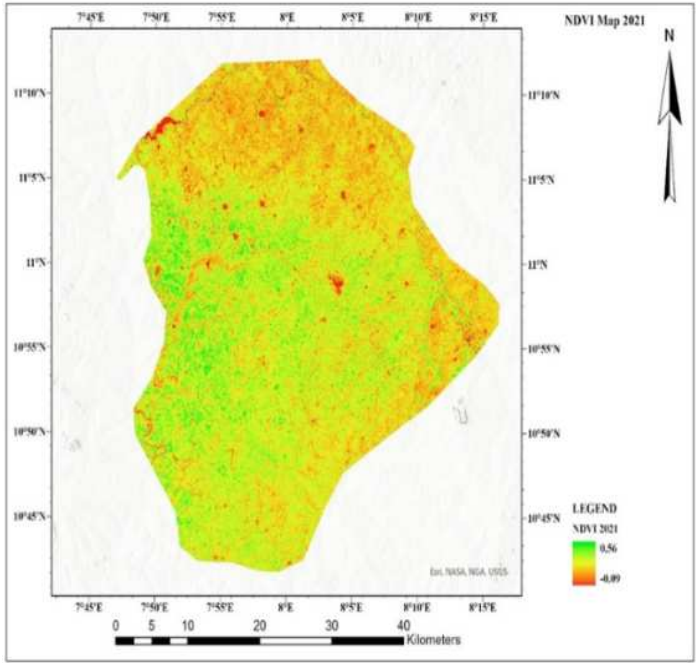
Effect of Urbanization on Vegetation



NDVI map 2001



NDVI map 2011



NDVI map 2021

RESULTS AND ANALYSES

Effect of Urbanization on Vegetation

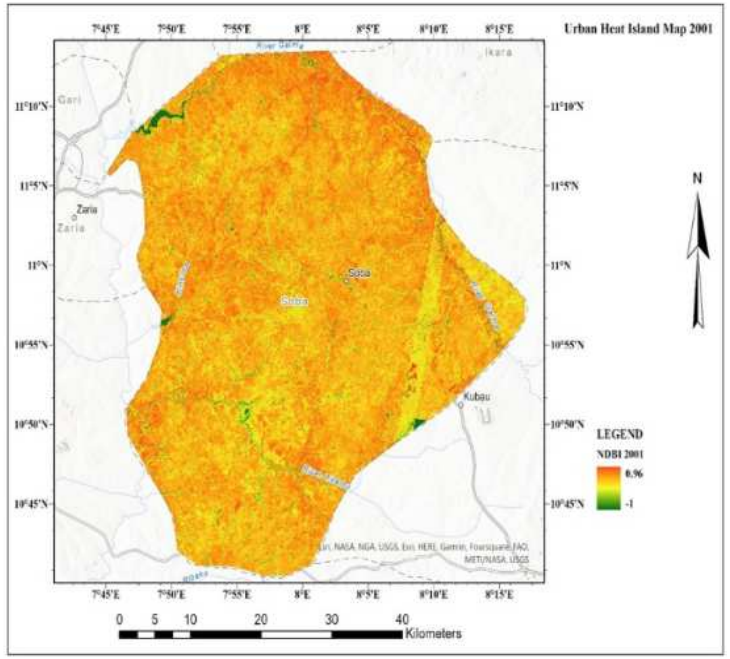
- NDVI pixels values range from -1 to +1. The higher NDVI levels suggest vegetation that is both more abundant and healthier.

- In 2001, the NDVI value ranged from -0.95 to 0.84, whereas in 2011, the value ranged from -0.2 to 0.42. The 2021 ranged from -0.09 to 0.56, lower than in 2001.

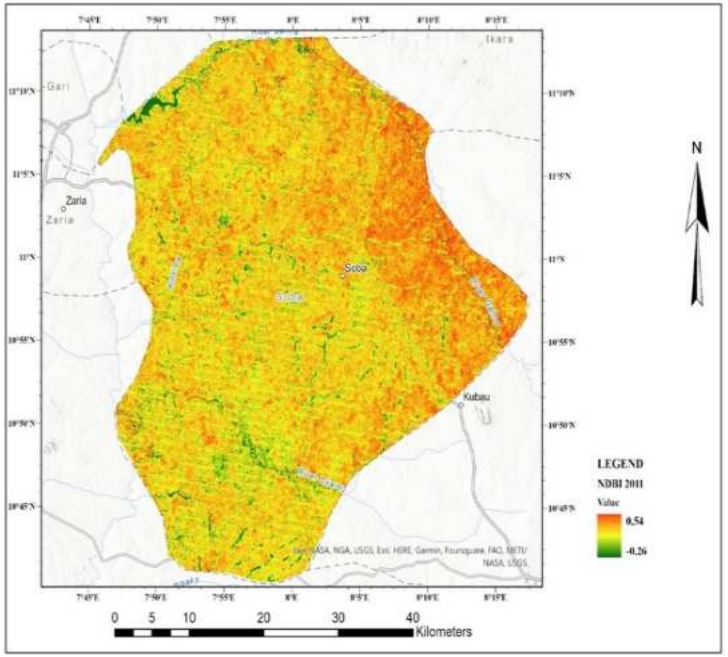
- The lower NDVI values are associated with more developed places, while higher NDVI values are associated with more naturally occurring surfaces, suggesting that urbanization does have an impact on the amount of vegetation.

RESULTS AND ANALYSES

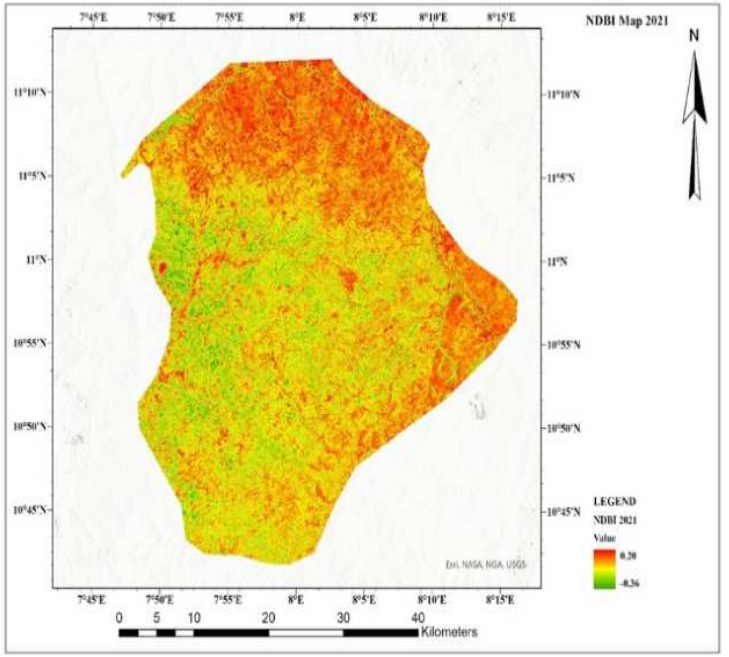
Effect of Urbanization on Vegetation



NDBI map 2001



NDBI map 2011



NDBI map 2021

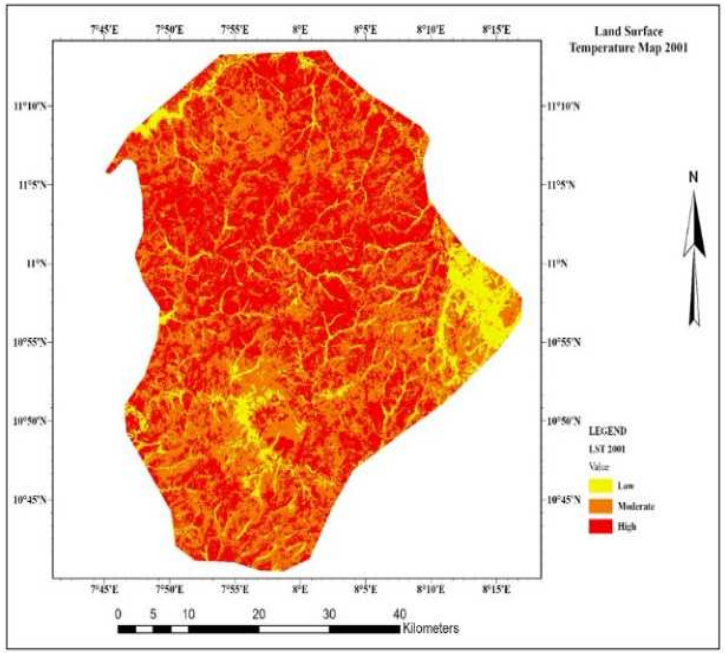
RESULTS AND ANALYSES

Effect of Urbanization on Vegetation

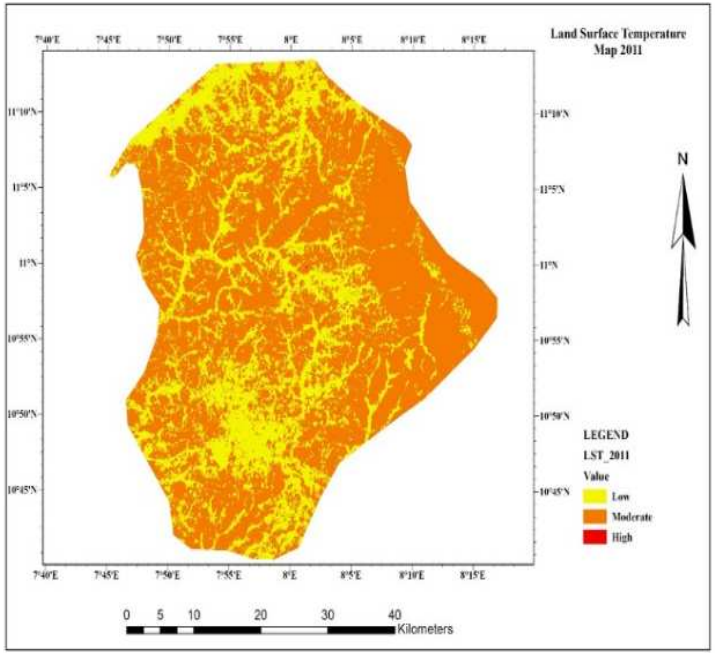
- The NDBI was used to identify built-up regions.
- The positive NDBI values are linked to more developed settlements, and negative NDBI values are linked to less developed natural surfaces.
- The NDBI values generally indicate that built-up areas have grown, whereas other land uses and land cover, particularly forest cover, have also increased and occasionally water decreased.

RESULTS AND ANALYSES

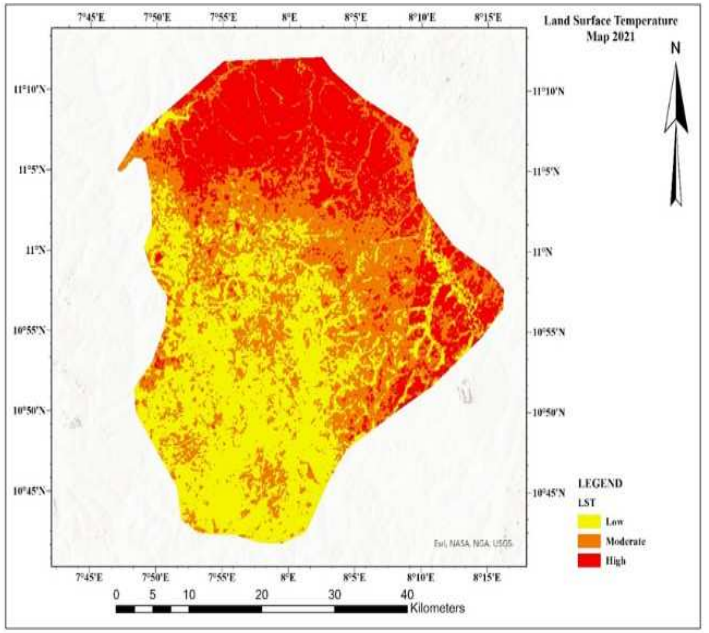
Spatial distribution of Land Surface Temperature (LST)



LST map 2001



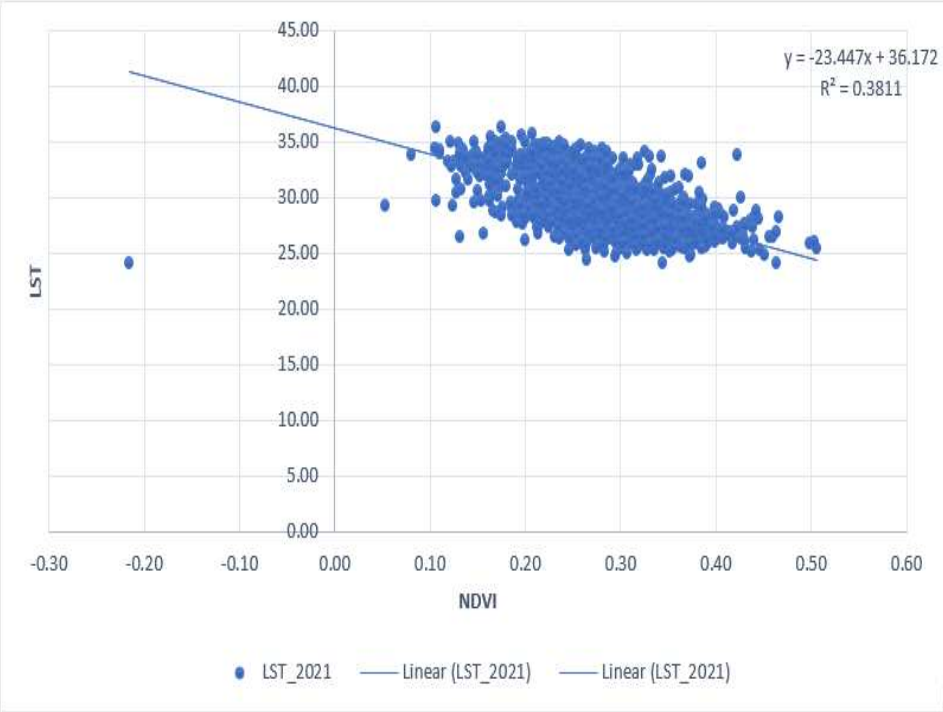
LST map 2011



LST map 2021

RESULTS AND ANALYSES

Spatial distribution of Land Surface Temperature (LST)



2021 Correlation between LST and NDVI

Table 6: LST statistics derived from Landsat images from 2001 to 2021

Year	Lowest Value	Highest Value	Mean	Standard Deviation
2001	18.22	48.93	30.29	1.46
2011	17.92	48.93	29.01	1.57
2021	22.33	48.88	29.65	2.50

RESULTS AND ANALYSES

Results show linear regression correlations between the elements and the relationship between LST and NDVI.

There is a weak correlation between LST and NDVI. This suggests that the amount of LST that may be obtained at a specific place is influenced by the presence of vegetation.

And it can be said that when vegetation is present, the temperature is lower than in an area that is built up.

CONCLUSION

There were significant changes in land cover, and the surface temperature has been noticeably rising due to increased development and a dearth of water bodies.

There was a weak link between LST and NVDI, however, NDBI and LST had a positive association since the correlation showed that LST rose as the built-up area grew.

Improving vegetation cover in the area will lessen the impact of UHI

It is recommended that the State Government should regularly monitor urban growth; and prioritize the plantation of trees within the community centers.

Thank you for listening

Any ?

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Commission 8

Spatial planning and development

Climate Resilience Actions for the Future