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Geographical Analysis of LST in Taloda Tehsil

Dr. Rahul V. Patil

Abstract

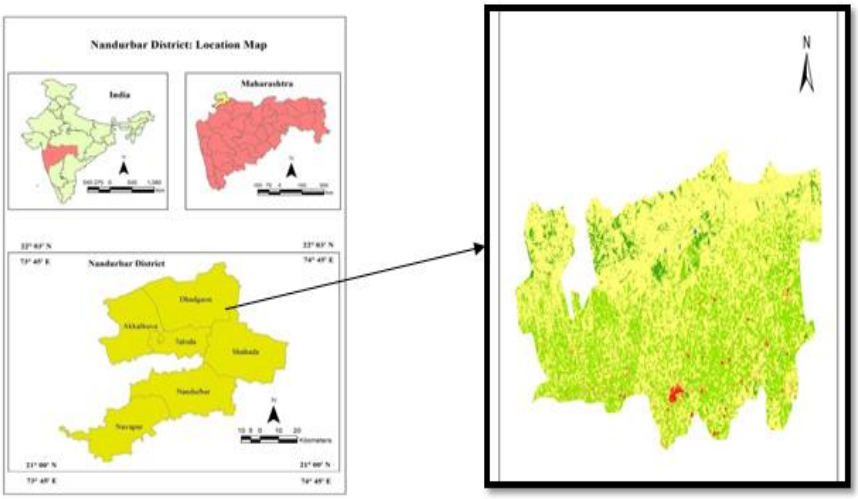
In an era increasingly defined by pronounced climatic shifts, this research paper undertakes an imperative examination of Land Surface Temperature (LST) trends within Taloda Tehsil, a critical region nestled within the broader Nandurbar district. The urgency of this investigation is underscored by the unambiguous reality of global warming, which has, in recent times, ascended to the forefront of critical environmental concerns, driven predominantly by the pervasive footprint of human endeavors. The relentless excessive utilization of finite natural resources, the burgeoning tide of pollution infiltrating our ecosystems, and the devastating scale of large-scale deforestation collectively stand as major, undeniable contributors to the relentless and steady ascent in the Earth's surface temperature. Tools such as Remote Sensing (RS), which allows for the acquisition of vast, objective spatial data from a distance, and Geographic Information Systems (GIS), which provides robust capabilities for integrating, analyzing, and visualizing this complex information, have been judiciously utilized.[1] This powerful combination facilitates the accurate detection and granular analysis of both the spatial distribution and temporal evolution of surface temperature shifts. Furthermore, recognizing the intricate relationship between land use and surface heat dynamics, the research has concurrently assessed Land Use Land Cover (LULC) data for Taloda Tehsil. This parallel investigation serves a pivotal role, allowing the researchers to meticulously explore the extent to which transformative land use changes – be it the expansion of concrete surfaces, the reduction of green cover, or alterations in agricultural practices.

Keywords: *LST, LULC, GIS, RS, Data, Natural Resource*

Introduction

Land Surface Temperature (LST) stands as a critically important metric for monitoring and precisely assessing long-term thermal variations, particularly within the dynamic fields of environmental and climate-related research.[1] Within Taloda Tehsil, situated in the broader Nandurbar district, a discernible and concerning increase in surface temperature has been observed over recent decades. This pronounced upward trend is primarily and undeniably linked to deforestation, which emerges as a singularly potent factor fundamentally altering the local climate. The widespread removal of forest cover invariably disturbs the delicate ecological equilibrium, leading directly to a marked reduction in vital evapotranspiration, a significant diminishment of natural shading that once cooled the ground, and a greater, more direct absorption of solar radiation by now exposed, bare land surfaces.[2] All these interconnected phenomena collectively contribute to the notably elevated surface temperatures. To precisely understand and quantify this alarming pattern, the study meticulously concentrated on four specific locations within the region that have, unfortunately, experienced substantial and visible deforestation, allowing for a focused analysis of cause and effect.

Location of Study Area:



Database & Methodology:

In this study, Landsat satellite imagery was employed to examine the Land Surface Temperature (LST) in Taloda Tehsil. The analysis utilized data from two distinct time periods: imagery from the year 1999 acquired via Landsat 7, and from the year 2022 acquired via Landsat 9. For each image, the thermal band was extracted to facilitate temperature analysis. The Digital Number (DN) values obtained from the thermal bands were first converted into spectral radiance using standard calibration equations. This radiance was then transformed into Brightness Temperature (BT), which was subsequently converted from Kelvin to degrees Celsius to reflect real surface conditions. Through this systematic process, the Land Surface Temperature for both years was accurately calculated and optimized, allowing for a meaningful comparison of temperature changes over time.

$$LST = \frac{BT}{1 + (W * BT)/14380 * ln(E)}$$

Where, LST = Land surface temperature (celcius)

W = Wavelength of emitted radiance

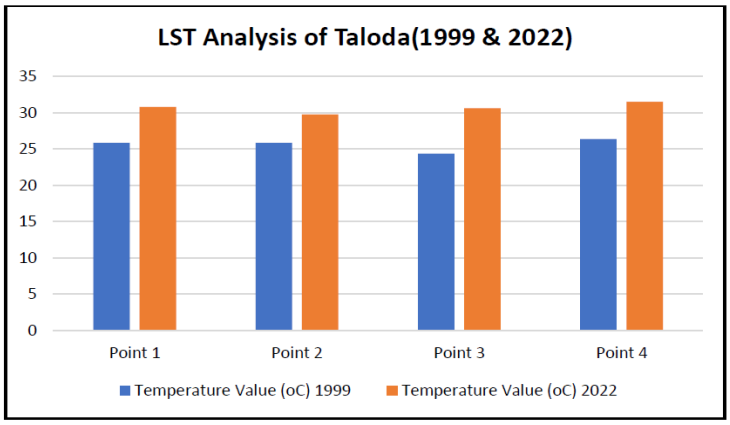
BT = Top of atmosphere brightness temperature (C)

E = Land surface emissivity (LSE)

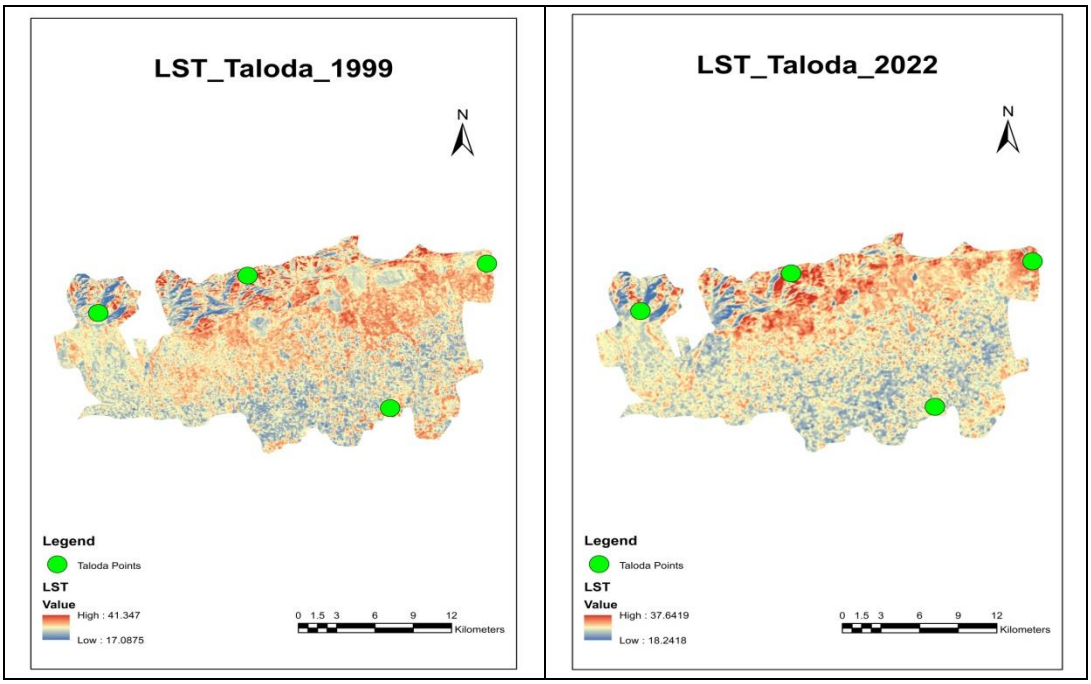
Results:

LST Calculations –Taloda (1999 & 2022):

Points	Temperature Value (^{o}C)		Difference (^{o}C)
	1999	2022	
Point 1	25.86	30.80	4.94
Point 2	25.86	29.77	3.91
Point 3	24.36	30.64	6.28
Point 4	26.36	31.52	5.16



The table charts represents land surface temperature (LST) data at four different points in Taloda tehsil for the years 1999 and 2022, highlighting the temperature change over the 23-year period. At Point 1**,** the temperature increased from 25.86°C in 1999 to 30.80°C in 2022, indicating a rise of 4.94°C**.** Similarly, Point 2 shows an increase from 25.86°C to 29.77°C**,** a difference of 3.91°C**.** Point 3 recorded the highest temperature change, rising from 24.36°C to 30.64°C, marking a significant increase of 6.28°C**.** Lastly, Point 4 exhibited a rise from 26.36°C in 1999 to 31.52°C in 2022, with a difference of 5.16°C**.** This data clearly reflects a consistent and notable increase in land surface temperature across all four points, suggesting a warming trend in the region, possibly due to environmental changes such as reduced vegetation, urban expansion, or climate variability.



Conclusion:

The given study shows a significant change in land surface temperature in Taloda tehsil between the years 1999 and 2022. This rise in temperature may be attributed to various environmental and anthropogenic factors, such as the reduction of natural vegetation cover and the expansion of new settlements in the study area. Deforestation, urbanization, and land use changes could have contributed to the increase in surface temperature, indicating a shift in the local climate and ecological balance.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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