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STUDY OF VARIOUS FACTORS INFLUENCE ON LAND SURFACE TEMPERATURE IN URBAN ENVIRONMENT

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Abstract:

Land surface temperature (LST) is an important for urban environment. Our research mainly based on the landuse and landcover (LULC) on LST. The research of our study tells how the LST variations based especially for a rapidly developing city such as Vellore, India. This study uses the techniques of remote sensing and geographic information system (GIS) to detect the temperature variation of LST. The spatial variability of texture in LST was done. These variations are also present in the images, and are responsible for the spatial patterns in an urban environment. The result values shows that both the spatial and temporal variation in surface temperature is associated with CO₂ concentration levels and thus affects the local land use pattern

Keywords: Land surface temperature, demographic, Landsat Thematic Mapper, Urban, CO₂

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INTRODUCTION

Due to rapid rise in global temperature increase in change of land use/land cover due to rapid growth of urban area (Aninruddha & Joshi 2014). Most urban areas have high temperature as due to effect of greenhouses gases like CO₂, methane, carbon dioxide and water vapour. Because of human population and industry in urban areas are influencing the LST. This phenomenon is widely observed in cities of their sizes and locations (Dousset & Gourmelon 2003). The urban heat refers to the relative warmth of urban surfaces and urban atmosphere number of factors are contributed development, have transformed over the landscape from natural cover types to built-up areas concern about global warming (Liu & Weng 2008). Satellite data were used for estimation of LST for monthly variations as well as for urban LULC conditions. In Landsat-8 has two bands 10 and 11 are used for the calculation of LST, band 11 is influencing through CO₂ band. So, our study is to estimate and compare the LST from Landsat on Urban environment and to study the spatial-temporal changes in our Vellore study area and what are the factors that are causing the increase of LST like the emission from cars, public transport and even personal vehicles (Venkatesh *et al.*, 2014). This paper is focused to estimate and compare the LST from Landsat on Urban Environment. To study the spatial-temporal changes in the study Vellore area and to study the various factor responsible for the increase in LST.

METHODOLOGY

Data Used and Study Area

But as per our study is concerned we have collected the data from Landsat series for the Vellore area and we are classifying the various factor which enhanced the LST from **Table 1**. We state that the various Landsat series data we have taken.

Table 1. Representing the Data Used for the Landsat series

Data	Month	Year
Landsat-7	May	2003
Landsat-5	May	2005
Landsat-5	May	2009
Landsat-8	May	2014
Landsat-8	May	2015

Estimation of LST

LANDSAT-5 data were collected from Earth Explorer and this were actually the Raster data and then we overlay with Vector data of the Vellore municipality area and then subset the data and then the Classification of the LST is done same process has been followed for LANDSAT-7 and LANDSAT-8. This are being shown if **Figs. 1–5**. The calculations of Land Surface Temperature as refer in the **Eqs. 1–2**.

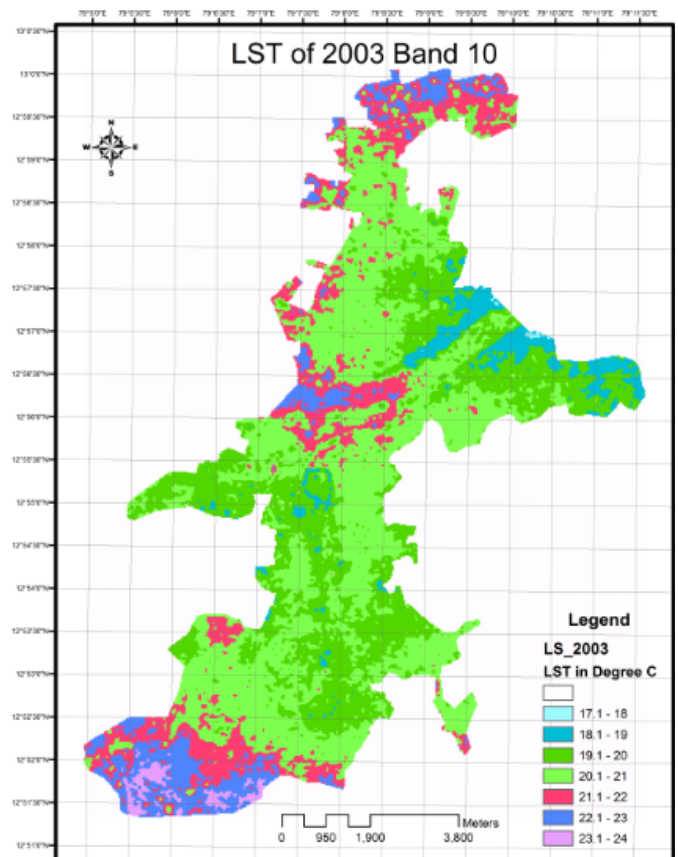


Fig. 1 LST of year 2003 of band 10

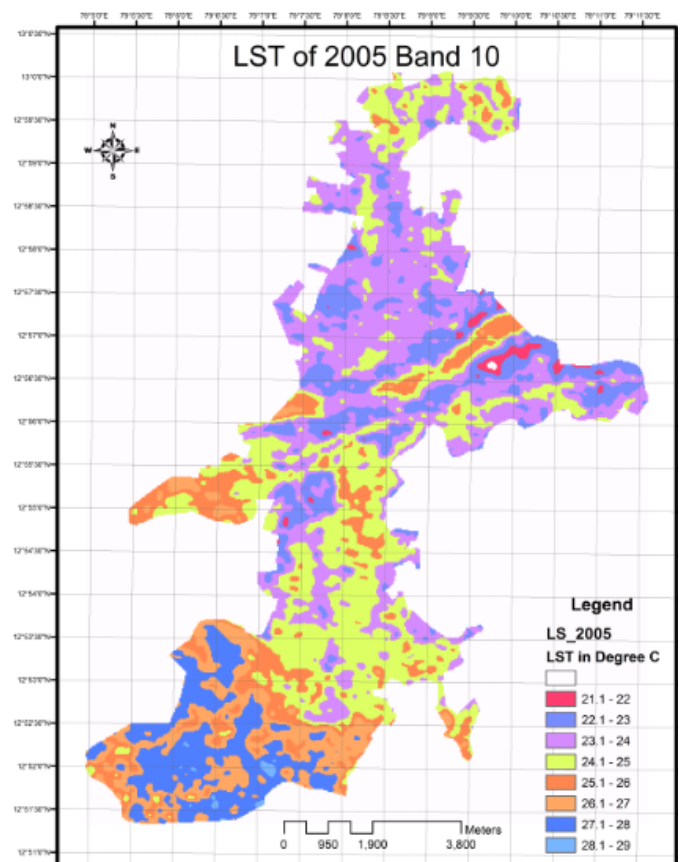


Fig. 2 LST of year 2005 of band 10

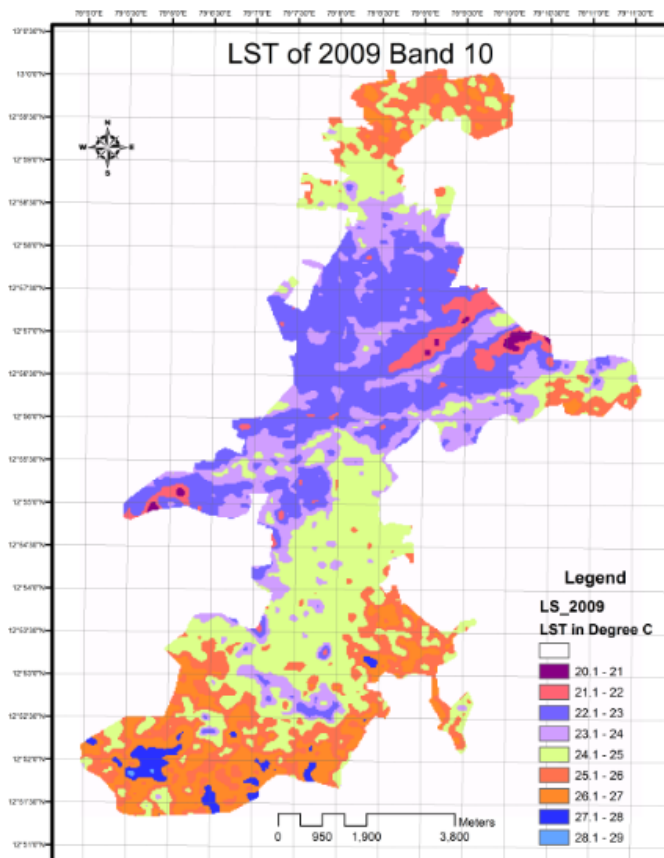


Fig. 3 LST of year 2009 of band 10

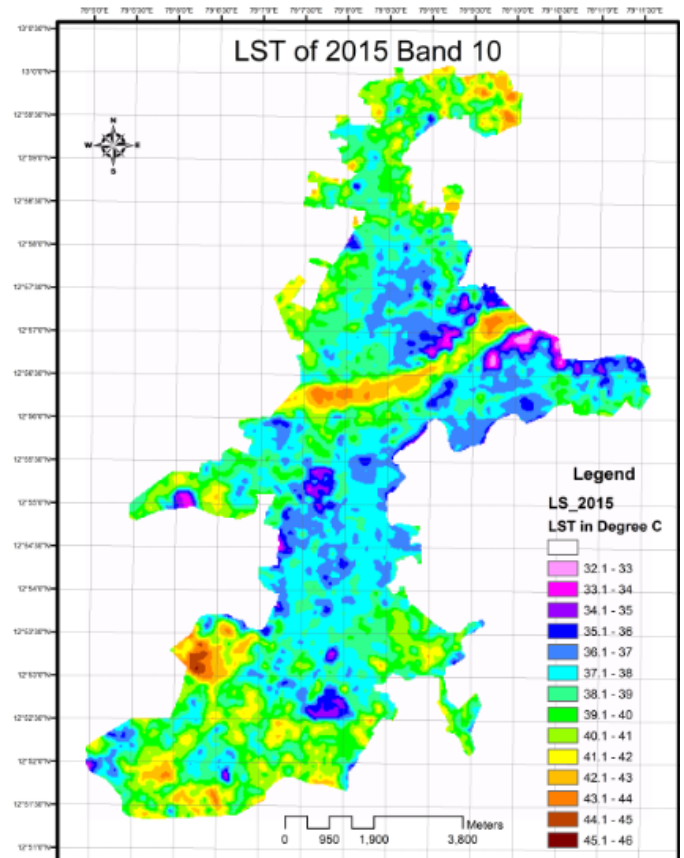


Fig. 5 LST of year 2015 of band 10

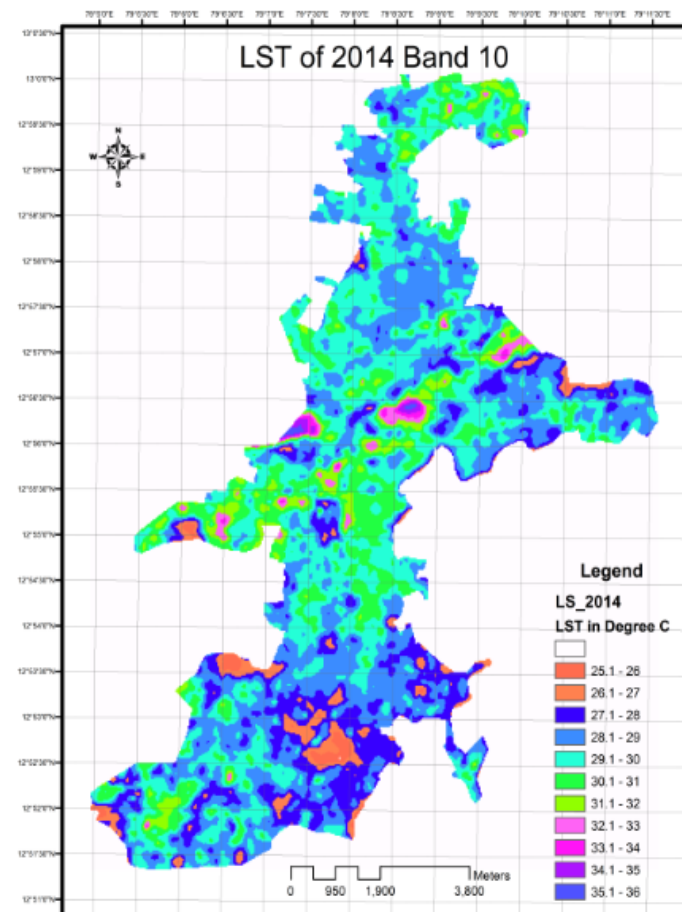


Fig. 4 LST of year 2014 of band 10

Step (a): To convert TOA values to TOA Brightness Temperature in Kelvin

$$K = (1321.08 / \log(774.89 / b_{10} + 1)) \quad (1)$$

Step (b): To convert Kelvin to Degree Celsius

$$C = b_{10} - 273 \quad (2)$$

RESULTS AND DISCUSSION

Estimation of LST and CO₂ analysis with LU/LC pattern

Satellite data was collected, employing of empirical formulas and produced statistics of thermal infrared images. The temperature is changing over a land surface and it is associated with LU/LC pattern, which may have effects on land surface temperature. LST statistics were produced from LANDSAT-8 imageries, LU/LC analysis have been done for same satellite imageries and CO₂ data were obtained from field observation data for the study of temperature variation and CO₂ distribution on LU/LC pattern as shown in Fig. 6.

Correlated LST with Land cover pattern

As per our studies concern we have taken the LANDSAT series data from the year 2003 to 2015 for particular Vellore bus-stand area and we obtained that there is increase in LST In urban area land cover

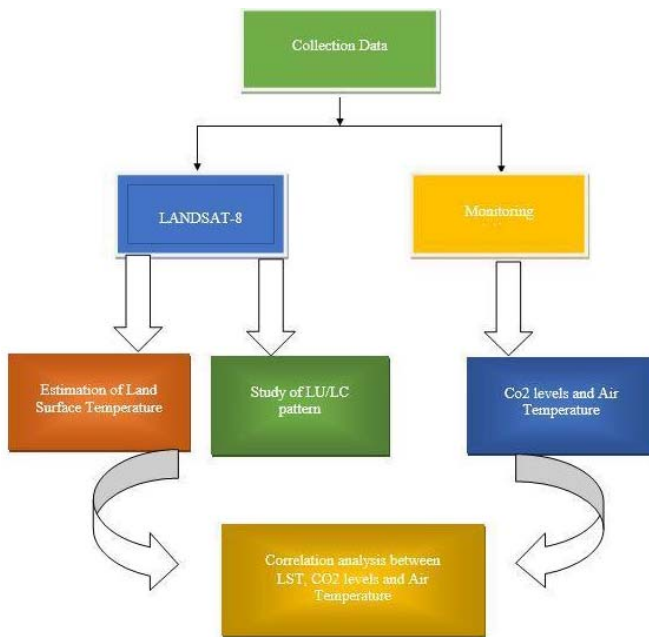


Fig. 6 Methodology adapted in the study

variation is remains same. But because of the CO₂ level increase because of the automobiles and therefore cause

in the significant rise in LST and also there is increase in the LST of 2°C as shown in **Table 2** and also shown in **Figs. 7–8**.

Table 2. Month of May LST for Vellore

Month	May-2014		Difference in Temperature (°C)
Classes	Band 10 (°C)	Band 11 (°C)	Band 10 – Band 11
River Sand	42.8	33.6	9.2
Vegetation	28	20	8
Urban	37	27	10
Waste land	38	27	11

CONCLUSION

From this study it can be conclude that estimation of LST and CO₂ analysis with LU/LC pattern, the Correlation of LST with Land cover pattern and the Study of Vellore area year wise estimation of LST is done and with the help of GIS we can able to classify the LST images. Though significant changes in the Urban area is not observed still the various factors increases the LST of the Vellore area.

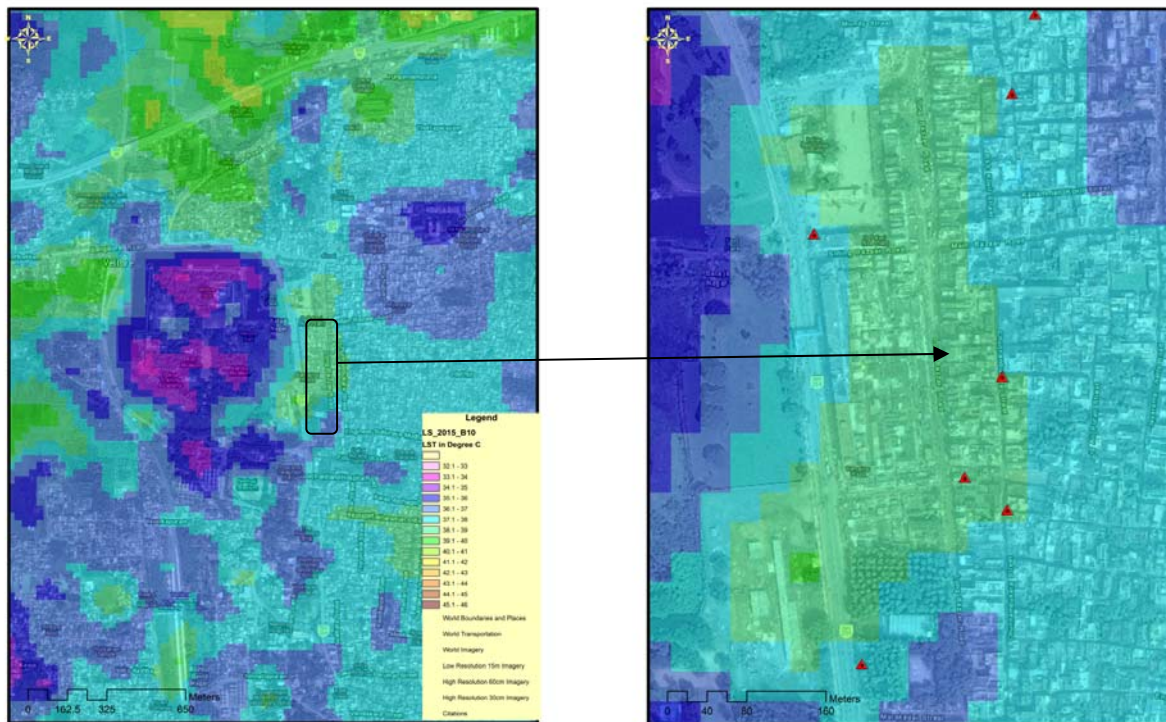


Fig.7 Correlation of LST of Band 10 of 2015 with Land Cover

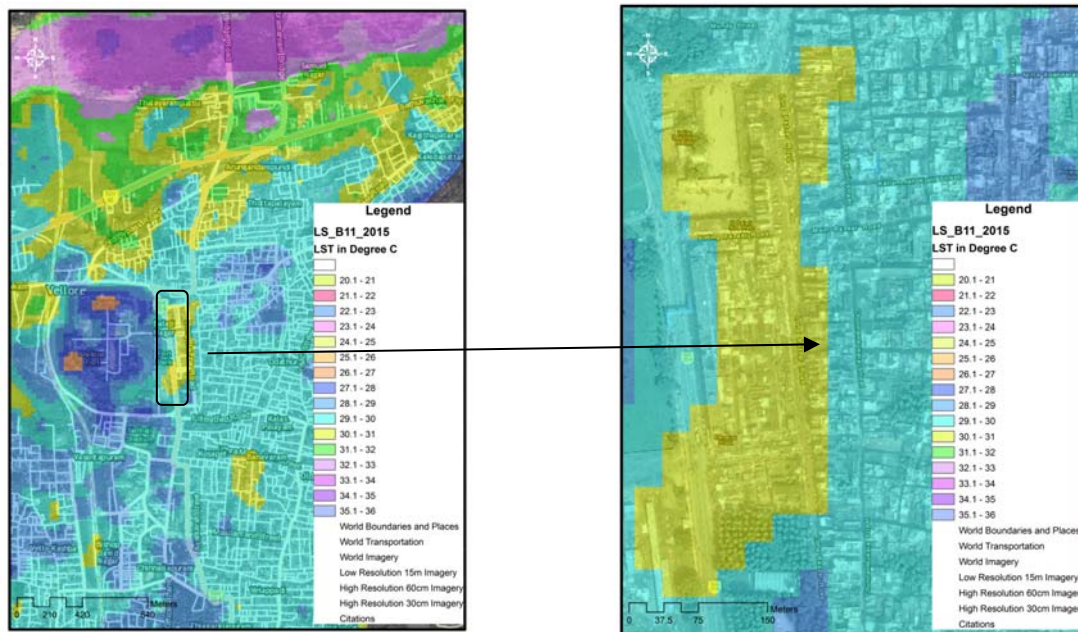


Fig. 8 Correlation of LST of Band 11 of 2015 with Land Cover

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