

Received: 12.01.2024

Accepted: 18.05.2024

Published: 12.06.2024

**Citation:** Naseeba U. (2024). Study of Urban Development in Nanjangud City, Mysuru District, Karnataka, India. *Geo-Eye*. 13(1): 27-29. <https://doi.org/10.53989/bu.ge.v13i1.naseeba>

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**Funding:** None**Competing Interests:** None

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Published By Bangalore University,  
Bengaluru, Karnataka

**ISSN**

Print: 2347-4246

Electronic: XXXX-XXXX

# Study of Urban Development in Nanjangud City, Mysuru District, Karnataka, India

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## Abstract

*Nanjangud, a prominent town in the Mysore district of Karnataka, India, has experienced significant urban and industrial growth over the past few decades. This study aims to analyze the land use and land cover (LULC) changes in Nanjangud from 1975 to 2024 using Landsat and Sentinel satellite imagery at decade intervals. By employing supervised classification techniques, the research seeks to provide a comprehensive understanding of the spatial and temporal dynamics of urban expansion and its environmental impacts. The study leverages Geographic Information System (GIS) and remote sensing technologies to monitor and map these changes accurately. The findings indicate increase in urban built-up lands, accompanied by a reduction in open spaces, vegetal and agricultural lands highlighting the need for sustainable urban planning and management in the town.*

**Keywords:** Urban Development; Urban Growth; GIS; Remote Sensing

## 1 Introduction

The study of Land Use and Land Cover (LULC) changes using GIS and remote sensing techniques has become crucial for understanding urban dynamics and planning sustainable cities. Urban growth and industrialization have greater impacts on land use patterns and tends to deteriorate the environs.<sup>(1)</sup> Discusses how urbanization leads to increased surface runoff and reduced vegetation cover, affecting local ecosystems.<sup>(2)</sup> Emphasizes the rapid urbanization in developing countries and discuss the dynamics and modeling of urban sprawl using GIS, highlighting the need for sustainable urban planning to mitigate adverse effects like

the loss of agricultural land and increased traffic congestion. Similarly,<sup>(3)</sup> complement these findings by focusing on Beijing, demonstrating significant urban growth and its impact on rural landscapes.<sup>(4)</sup> Explored the use of remote sensing in monitoring deforestation and land degradation, discussing the challenges of detecting subtle changes in vegetation cover and proposing methods to enhance the sensitivity and accuracy of remote sensing data. The application of GIS and remote sensing in urban studies has evolved significantly. The integration of Landsat and Sentinel imagery, as explored by<sup>(5)</sup> has enhanced the temporal resolution and accuracy of LULC monitoring.

This study focuses on the application of these techniques to monitor the LULC changes in Nanjangud from 1975 to 2024, leveraging satellite imagery from Landsat and Sentinel missions. The reviewed literature underscores the effectiveness of remote sensing and GIS in LULC studies and the importance of accurate classification methods. However, there is a lack of long-term studies specifically focused on Nanjangud, highlighting a gap that this study aims to fill. Furthermore, integrating multi-source data (Landsat and Sentinel) for a comprehensive temporal analysis remains underexplored in this Nanjangud region.

## 2 Study Area

Nanjangud, a satellite town for Mysuru city in the Mysore district of Karnataka, India, is situated on the banks of the Kabini River and it is easily accessible via road, rail and air. The town covers an area of about 14.765 square kilometers with 31 administrative wards under Nanjangud City Municipal Council (CMC) and According to the 2011 Census of India, Nanjangud town had a total population of approximately 50,598 people. Historically, Nanjangud town is known for its rich cultural heritage, historical significance, and religious importance as it is referred as "Dakshina Kashi" or the Varanasi of the South, owing to its prominent temple dedicated to Lord Shiva, known as the Srikanteshwara Temple. The town's history dates back to the time of the Cholas, Hoysalas, and the Vijayanagara Empire, making it a site of great archaeological and historical interest. The industrial area of Nanjangud significantly influences the town's economy and infrastructure by enhancing the employment and economic growth. In the view of both urban expansion, industrialisation and heritage history, there is a need of proper management and sustainable practices of study area.

## 3 Materials and Methodology

The study aims to analyze the land use and land cover (LULC) changes in Nanjangud town from 1975 to 2024 using Landsat and Sentinel satellite imagery at decade intervals. The supervised classification technique will be employed to classify the images into various LULC categories. Cloud-free, Multi-sensor imagery through Landsat Mission (Landsat imagery for the sequence of years: 1975, 1985, 1995, 2005, 2015) and Sentinel-2 imagery (2024). Image classification was done through the supervised classification algorithm Maximum Likelihood Classifier (MLC) and converted to thematic output with five land use classes such as AG-Agricultural Land, BU-Builtup Land, OS-Open Space, VG-Vegetation, WB- Waterbodies. After that, temporal analysis is done to identify and quantify LULC changes across the decades to analyze the trends and patterns in LULC changes over the study period, focusing on urban expansion,

industrial growth, loss of vegetation, open spaces, and changes in agricultural land. These key findings of the LULC change analysis provides recommendations for urban planners, policymakers, and stakeholders to address the challenges posed by rapid urbanization and industrialization.

## 4 Result and Discussion

Following thematic maps 1-6 (Figure 1) are derived through image classification techniques based on the cloud based google earth engine platform and status of LULC are mapped below.

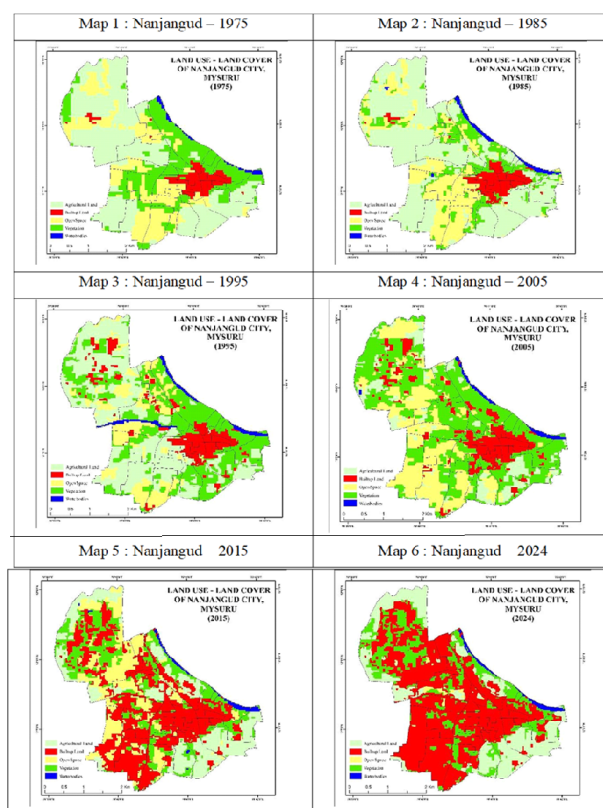
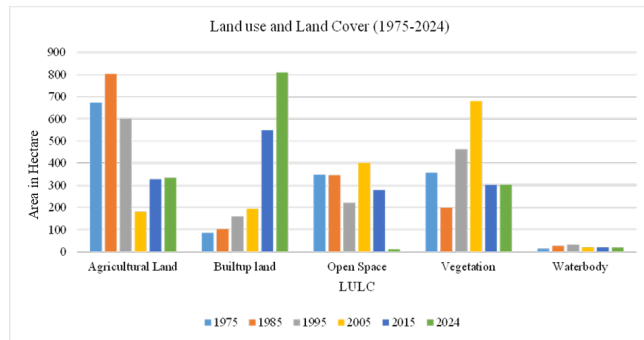


Fig. 1.

The Table 1 and Bar Graph 1 based on aerial statistics from Map 1 to 6 (Figure 1) shows the details of the changes in land use and land cover (LULC) from 1975 to 2024, measured in hectares.

Agricultural land saw an increase from 673.21 hectares in 1975 to a peak of 802.47 hectares in 1985, followed by a significant decrease to 181.23 hectares by 2005, and a modest recovery to 333.58 hectares by 2024. Built-up land exhibited a consistent rise, starting at 85.04 hectares in 1975 and escalating to 809.15 hectares by 2024, reflecting substantial urban expansion. Open space initially decreased from 347.7



Graph 1: Land use Land Cover of Nanjangud (1975-2024)

hectares in 1975 to 220.37 hectares in 1995, then saw a brief increase to 401.23 hectares in 2005, before drastically falling to 12.11 hectares by 2024. Vegetation decreased from 356.84 hectares in 1975 to 199.13 hectares in 1985, then increased significantly to 679.78 hectares by 2005, and stabilized around 302.57 hectares by 2024. Waterbodies increased from 13.71 hectares in 1975 to 32.18 hectares in 1995, followed by a slight decrease and stabilization around 19 hectares from 2005 to 2024. Overall, the data indicates major urbanization and land use changes, particularly a reduction in open spaces and shifts in agricultural and vegetation areas.

Table 1. Nanjangud LULC Area in Hectares ( Ha)  
(Year 1975-2024)

LULC	1975	1985	1995	2005	2015	2024
Agricultural Land	673.21	802.25	601.49	181.23	326.84	333.98
Builtup land	85.04	103.51	159.32	194.46	549.02	810.08
Open Space	347.61	345.4	220.37	401.12	278.46	12.33
Vegetation	356.84	199.13	463.02	679.78	301.79	302.80
Waterbody	13.71	25.99	32.18	19.80	20.28	19.61
Total Area (Ha)	1476.50	1476.50	1476.50	1476.50	1476.50	1476.50

## 5 Conclusion

Critical role of remote sensing and GIS in understanding urban expansion, LULC changes, and environmental monitoring are addressed in this study. Through the identified gaps, future research works relating to urban morphodynamics can contribute to more effective urban planning and environmental management, ensuring sustainable development in the Nanjangud region.

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