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RESEARCH ARTICLE

Exploring Land Use Trends i n Mysuru District: An Analysis of Spatial Dynamics

R Shiva Kumar[1]*

1 *Guest Faculty, Dept. of Geography, Bangalore University, Jnanabharathi Campus, Bengaluru*

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* **Corresponding author**.
drshivakumarrajendra@gmail.com

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Abstract

The purpose of this study is to examine the dynamics of land use and land cover in Mysuru District from 2018 to 2022 utilizing geographic information system (GIS) tools and remote sensing techniques. We used Sentinel-2 land cover data from the Environmental Systems Research Institute, Inc. (ESRI) to examine changes in shrubland, built-up areas, agricultural land, water bodies, and vegetation. Land cover patterns were analyzed and their temporal and spatial trends determined using image classification, change detection analysis, and theme mapping. The study emphasizes how crucial it is to comprehend land use dynamics in order to make wise decisions and implement sustainable land management techniques in the area.

Keywords: Mysuru District; Land Use; Land Cover; Sentinel2; Remote Sensing; GIS; Sustainability; Environmental Monitoring

Introduction

Change in LU/LC patterns help in predicting the main forces driving over global environmental change have impacts on a wide range of environmental attributes such as., water quality, land, air resources, ecosystem processes, climate change through greenhouse gas fluxes and surface albedo effects on all spatial and temporal scales. Globally, the dynamics of land use and land cover (LULC) greatly influence the socioeconomic, biological, and environmental landscapes of many regions. For the purposes of resource management, environmental conservation, and sustainable development, an understanding of these processes is crucial. This study examines the land use and land cover (LULC) patterns in the southern Indian district of Mysuru, considering both national and international trends. With its varied landscapes and rich cultural legacy, the Mysuru District has experienced substantial changes in land cover and use over time. Numerous factors, including population expansion, urbanization, industrialization, agricultural methods, and natural processes, have an impact on these changes. For the purpose of determining if land resources are sustainable, seeing possible environmental issues, and developing practical solutions, it is imperative to track and analyze these dynamics.

This paper's main goal is to perform a thorough examination of the LULC dynamics in Mysuru District between 2018 and 2022. The project attempts to determine patterns, trends, and drivers of land cover change in the region using data from satellite imagery and geographic information system (GIS) tools.

The goal of the article is to shed light on the geographical and temporal dynamics of land use in Mysuru District by analyzing the distribution and changes in various land cover classes, such as vegetation, agricultural land, built-up areas, and shrubland. These classes include water bodies and shrubland.

The paper will examine the data collection and analysis technique, show the LULC analysis results, and talk about the ramifications of the findings in the sections that follow. We hope that this thorough analysis will improve our knowledge of the dynamics of land use in the Mysuru District and help to advance sustainable land management techniques.

Study Area

Located between latitudes 11°44' N and 12°39' N and longitudes 75°54' E and 77°8' E, the Mysore district covers 6320 square kilometers, or around 3.29 percent of the total land area of Karnataka State. Geographically, it shares borders with the states of Kerala and Mandya district to the north, Chamarajnagar district and the state to the south, Kodagu district to the west, and Chamarajnagar district to the east. Mysore, one of Karnataka's four revenue divisions, is ideally located and has good access to Bangalore, the state capital, which is home to a plethora of important business and economic activity.

The region has a temperate climate with noticeable seasonal variances, primarily due to the influence of the tropical monsoon. With an average daily high temperature of 34°C and an average daily minimum temperature of 21°C, April is the hottest month of the four main seasons. With an average daily maximum temperature of 27°C and an average daily minimum temperature of 16°C, December, on the other hand, is the coldest month. It is possible for the temperature to fall below 11°C in a single day in the winter. Because of its ideal temperature range, which supports a variety of human activities, Mysore is a desirable place to settle and explore.

Seven taluks, 33 hobilies, 235 Panchayaths, five towns, three municipalities, and one city corporation make up the Mysore district as of right now. It includes 124 deserted villages in addition to 1216 populated villages, all of which contribute to the district's varied socioeconomic environment. The Mysore district is a hive of activity, drawing in both locals and tourists with its abundance of chances and attractions. Its rich historical and cultural legacy, strategic location, and pleasant temperature complete this picture.

Objectives

- Analyze land use dynamics in Mysuru District from 2018 to 2022 and to understand the drivers and implications of these changes, aiming to inform sustainable land management practices.

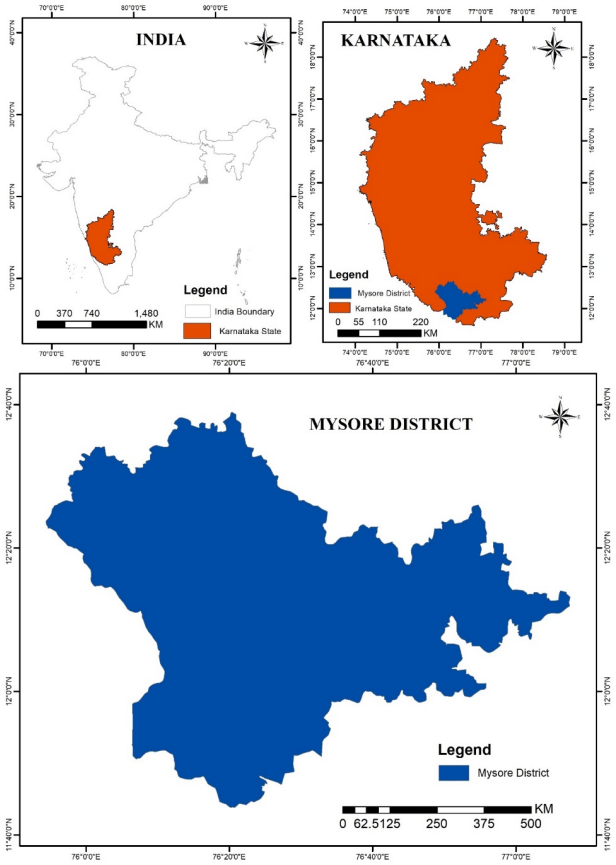

Fig. 1. Location Map of Mysuru district

Methodology

The Environmental Systems Research Institute, Inc. (ESRI) contributed Sentinel-2 land cover data, which were integrated into the study's methodology. Detailed analysis of land cover dynamics was made possible by ESRI's remote sensing and GIS software, which made use of high-resolution multispectral imagery obtained by the Sentinel-2 mission. Temporal changes in land cover were discovered and depicted using themed maps created with GIS software through picture classification and change detection techniques. To confirm the classification results and guarantee the accuracy of the results, accuracy evaluations were also carried out. In order to improve data interpretation and offer a clearer understanding of the dynamics of land use and land cover in Mysuru District from 2018 to 2022, graphical representations of the data were used.

Result and Discussion

- **Water Bodies:** Over time, the area covered by water bodies varies; it peaks in 2020 (231.40 sq.km) and then

Table 1. Land use

Years	2018	Percentage(%)	2019	Percentage(%)	2020	Percentage(%)	2021	Percentage(%)	2022	Percentage(%)
Water body	186.27	2.95	204.95	3.25	231.40	3.67	207.23	3.28	241.57	3.83
Vegetation	822.31	13.03	896.69	14.21	1038.39	16.45	890.37	14.11	1152.59	18.26
Agricultural Land	4287.91	67.95	4265.22	67.59	4179.09	66.22	4209.94	66.71	4121.59	65.31
Built up Area	435.27	6.90	452.42	7.17	462.85	7.33	475.44	7.53	486.82	7.71
Shcrubland	579.04	9.18	491.52	7.79	399.06	6.32	527.83	8.36	308.23	4.88
Total	6310.79	100.00	6310.79	100.00	6310.79	100.00	6310.79	100.00	6310.79	100.00

declines in 2021 (207.23 sq.km) before increasing once more in 2022 (241.57 sq.km). Changes in precipitation patterns, human activity impacting water resources, and natural variations in water levels can all be responsible for these shifts.

- **Vegetation:** Although there are variations in the amount of vegetation cover, there is a general upward tendency over time, with the largest area recorded in 2022 (1152.59 sq.km). This growth could be a result of increased agricultural production, afforestation, or natural regeneration processes that improve ecosystem services and biodiversity.
- **Agricultural Land:** Throughout the study period, the acreage of agricultural land remained generally steady, with only little changes noted. The district's significance for food production and the agricultural economy is highlighted by the continuous presence of a sizable agricultural land area, which ranges from 4121.59 sq.km to 4287.91 sq.km.

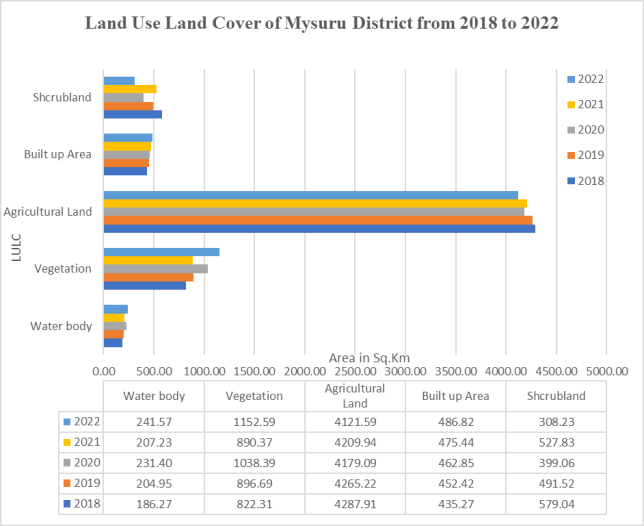

Fig. 2. Land Use Land Cover of Mysuru District from 2018 to 2022 (with table of Area inSq.Km) (Source: Environmental System Research Institute, Inc.(ESRI))

- **Built-up Area:** The area that is built up has gradually increased over time, indicating Mysuru District's infrastructure development and urbanization. This growth (from 435.27 sq. km in 2018 to 486.82 sq. km in 2022) emphasizes the necessity of sustainable urban design techniques as well as the mounting strain on land resources.

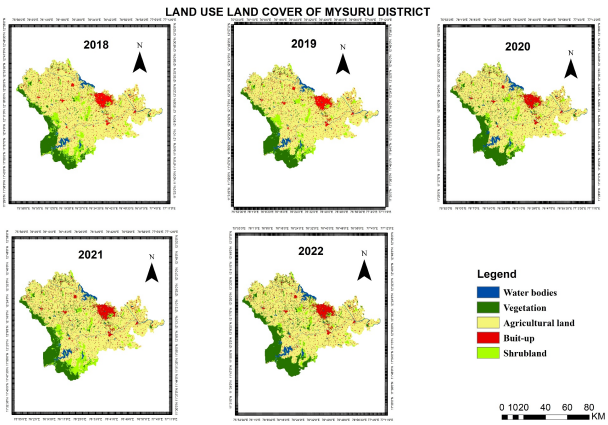

Fig. 3. Land Use Land Cover of Mysuru District from 2018 to 2022. (Source: Environmental System Research Institute, Inc.(ESRI))

All years had the same overall land area of 6310.79 sq.km, guaranteeing the analysis's thoroughness. The dynamic shifts in land cover and use patterns highlight the intricate relationships between manmade and natural processes that shape the Mysuru District's terrain. For the region's environmental conservation efforts, sustainable development, and well-informed decision-making, it is imperative to comprehend these processes.

The percentage distribution of the various land cover classes in the Mysuru District from 2018 to 2022 is shown in Table 1 . Over the course of the research period, the proportions of each land cover class—vegetation, agricultural land, built-up area, shrubland, and water body—show different patterns, illustrating the district's dynamic changes in landscape.

Table 2. Land Use Land Cover of Mysuru District in percentage (%) from 2018 to 2022

Sl. No	LULC	2018 (%)	2019 (%)	2020 (%)	2021 (%)	2022 (%)
1	**Water body**	2.95	3.25	3.67	3.28	3.83
2	**Vegetation**	13.03	14.21	16.45	14.11	18.26
3	**Agricultural Land**	67.95	67.59	66.22	66.71	65.31
4	**Built up Area**	6.90	7.17	7.33	7.53	7.71
5	**Shcrubland**	9.18	7.79	6.32	8.36	4.88
6	**Total**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

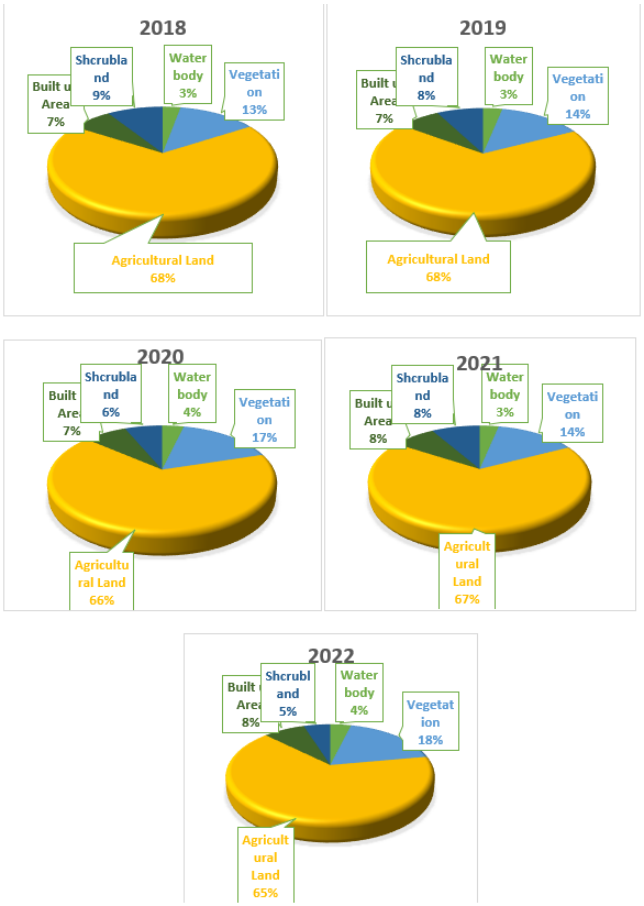

Fig. 4. Temporal Variation of Land Use and Land Cover Composition in Mysuru District: Percentage Distribution from 2018 to 2022

- **Water Body:** From 2.95% in 2018 to 3.83% in 2022, there has been a minor increase in the percentage of water bodies. This pattern indicates that water bodies have been gradually expanding over time, maybe due to influences from hydrological dynamics, land use changes, and variations in precipitation patterns.
- **Vegetation:** The proportion of vegetation cover increased from 13.03% in 2018 to 18.26% in 2022, showing a noteworthy development tendency. This increase suggests favorable ecological dynamics that support increased biodiversity and ecosystem services. These dynamics may be fueled by afforestation initiatives, farming methods, and natural regeneration processes.Agricultural Land: Despite some minor variations, agricultural land continues to be a dominating feature of the study area. The district's considerable agricultural activity and economic significance in food production are reflected in the comparatively high percentage of agricultural land, which ranges from 65.31% to 67.95%.
- **Built-up Area:** From 6.90% in 2018 to 7.71% in 2022, the percentage of built-up areas is steadily rising. This pattern points to the continued infrastructure and urbanization of the Mysuru District, which is causing habitat loss and land conversion and calling for prudent urban planning and sustainable land management techniques.
- **Shrubland:** Over the course of the study period, the percentage of shrubland areas varies; notably, it declines from 9.18% in 2018 to 4.88% in 2022. This decline may be the consequence of land being converted for urban or agricultural uses, underscoring the fragility of natural ecosystems and the significance of conservation initiatives to protect biodiversity. The analysis's thoroughness is demonstrated by the total land cover percentages, which stay steady at 100% throughout all years. The dynamic shifts in the distribution of land cover classes show how human activity and natural processes interact to shape the Mysuru District's landscape. For the region's sustainable growth, environmental preservation, and well-informed decision-making, an understanding of these LULC dynamics is crucial.

Conclusion

The examination of the dynamics of land use and land cover in Mysuru District from 2018 to 2022 offers important new perspectives on how the area is developing. It is clear from a review of data on shrubland, agricultural land, water bodies, built-up areas, and vegetation that the district has seen dynamic changes in the composition of its land cover, which have been influenced by both natural and human-caused processes. Throughout the course of the study, a few notable

trends surfaced. Increases in afforestation and natural regeneration processes may have contributed to the steady rise in vegetation cover, which has improved biodiversity and ecosystem services. On the other hand, changes were seen in shrubland areas, a sign of shifting land use patterns and habitat degradation. The district's importance in food production and the agricultural economy is shown by the stability of its agricultural land area. The steady growth of populated regions, however, draws attention to the strains that infrastructure and urbanization place on available land, underscoring the significance of sustainable urban planning techniques in reducing negative environmental effects. The dynamic character of hydrological processes and the requirement for efficient water resource management techniques are highlighted by the variations seen in water body areas. In order to solve issues with water security and guarantee the sustainability of water resources in the area, it is crucial to comprehend these processes. To sum up, the results of this investigation offer significant perspectives for decision-makers, scholars, and interested parties engaged in land administration and ecological preservation in the Mysuru District. Making educated decisions to support sustainable development, protect biodiversity, and conserve the environment for future generations can be accomplished by identifying and comprehending the factors that influence changes in land use and land cover. To track changes, evaluate repercussions, and modify management measures in response to changing environmental conditions and socioeconomic dynamics, ongoing study and monitoring are required.

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