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A Spatio-temporal Analysis of Land Use-Land Cover in Rajsamand City (1991–2021)

*Dr. Priyanka Chauhan
Assistant professor, Department of Geography, Government College, Chaksu (Jaipur)
** Hemlata Ojha
Research Scholar, Department of Geography
Mahatma Jyoti Rao Phule University, Jaipur

Abstract:- The city of Rajsamand has experienced a vast change in land use and land cover in the last few decades. The main objective of this study is to analyze the change in land use/land cover (LULC) of Rajsamand urban area. Various temporal Landsat imagery (Thematic Mapper) has been used for this study, particularly Landsat 5 TM and Landsat 7 Enhanced Thematic Mapper (ETM+) images from 1991 and 2021, during the study period of thirty years. Remote sensing is used to detect and measure land use pattern changes in the city. A Supervised Classification method by maximum likelihood method has been used to classify and map land use pattern types. The Kappa coefficient and the overall accuracy percentage have been measured to assess the accuracy of the research. Land use is changing as a result of rapid urbanization in Rajsamand urban area, study shows that in the last 30 years from 1991 to 2021, humanized land area i.e., buildings and construction structures has increased, which is more classify as urban area. Urbanization refers to industrialization and rapid growth in urban population. Land management is one of the most important elements in the development of the city. According to the present scenario, valuable agricultural land is being converted into non-agricultural land on the pretext of urban expansion of Rajsamand. The findings of this study provide information on changes in land use patterns that Rajsamand city officials can use to develop sustainable development plans.

Keywords:- *Rajsamand; remote sensing and GIS; Land Use/Land Cover (LULC); Urbanization.*

I. INTRODUCTION

Gathering information about Land-use and Land-cover (LULC) change is very important in current time for a better understanding of relationships and interactions between humans and the Ecology. "Remote sensing (RS) data have been one of the most important data sources for studies of LC spatial and temporal changes. In fact, multi-temporal RS datasets, opportunely processed and elaborated, allow to map and identify landscape changes, giving an effective effort to sustainable landscape planning and management [Dewan et al., 2009]."[1] Identification of land cover establishes the baseline from which monitoring activities can be performed. Rajsamand is very important city in Southern Rajasthan. Marble industry makes it more important as it became major trade center of marble after 1991. It is the district headquarters and the main service center of the district. It was the district headquarters in Mewar state, but it was made the sub-district headquarters in 1941 at the time of the re-determination of the boundaries of the districts. At the time of formation of United Rajasthan in 1948, it was given the status of a subdivision headquarters of Udaipur division. Rajsamand district was formed by the state government on April 10, 1991 by including the area of seven tehsils of Udaipur district. The special growth of this city is visible in the last six decades after independence. The population of this city was 5432 in the year 1951, which increased to 55687 in the year 2001 and 88000 in the year 2021, which means that the population has increased sixteen times in these seventy years.

Apart from the establishment of industrial units in the last three decades, after it became the district headquarters in 1991, rapid development of this city is taking place due to the establishment of administrative offices and institutions. Presently the total urbanized area of the city is 3340 acres out of which 2966 acres have been developed. But with rapid development, problems related to development have also arisen, in which inadequate housing facilities for the growing population, increasing traffic, unplanned and inadequate commercial services, lack of basic facilities, establishment of scattered and uncontrolled industrial units and their generated pollution etc. are the main problems of the city. Rajsamand Municipality Town is established in 55 Sq. Km area. That is, it is spread over 13590 acres of land area, out of which 7751 acres comes under the urban area. Out of the above urban area, only 2891 acres is actually developed urban area and rest of the area includes nurseries and plantations, reservoirs and river drains, vacant land and agricultural land.

[1] Dewan A.M., Yamaguchi Y. (2009) - Using remote sensing and GIS to detect and monitor land use and land cover change in Dhaka Metropolitan of Bangladesh during 1960-2005.

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II. THE STUDY AREA

Kankroli being an important pilgrimage place in the state of Mewar, this city has been of special importance. The present day Rajsamand city is a city made up of two twin settlements named Kankroli and Rajnagar. The city is located in the eastern half of Rajasthan, to the east of the Aravalli Mountain range. Rajsamand city is situated at 25°24' north latitude and 73°52' east longitude. The condition of this city is very desirable from the point of view of transportation. Being located on National Highway No. 08, this city is directly connected to Delhi, Jaipur, Ajmer, Beawar, Udaipur and Ahmedabad and Mumbai. This city is also the junction of national and state highways. Located at the starting point of East side Kankroli-Deoli State Highway No. 12, this city is also connected to major industrial cities like Bhilwara, which is about 90 km from here. The climate here is temperate. The maximum daily average temperature in summer is 42 °C and the minimum average temperature in winter is 7 °C. The average annual rainfall of this city has been recorded as 571.9 milliliters.

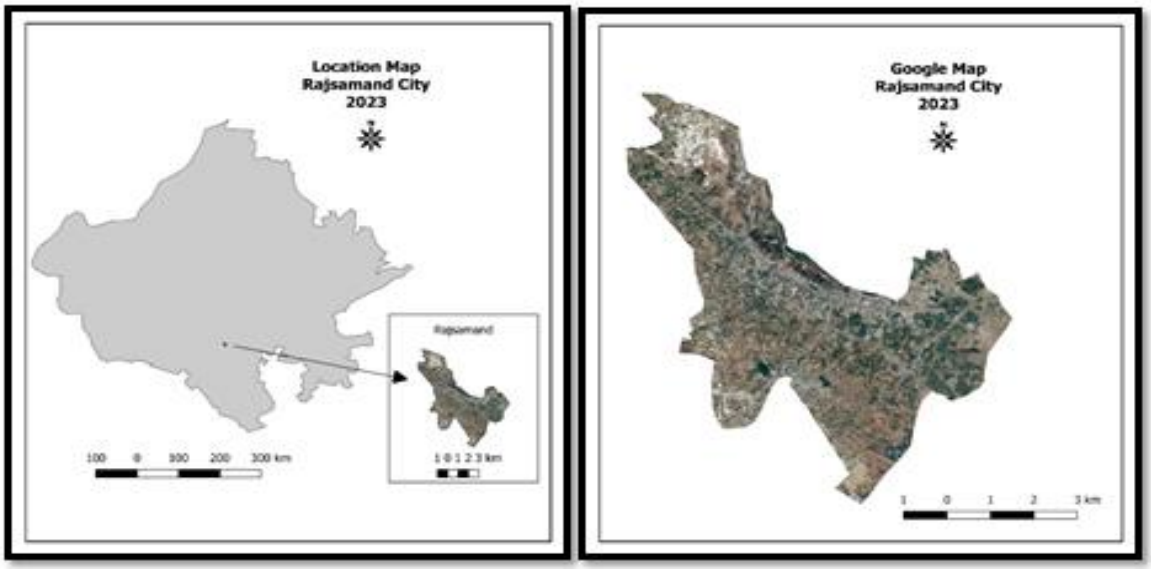

Fig 1.1 & 1.2 (Left & Right) Location map & Google Map of the study area.

III. OBJECTIVE

- To detect change in Land-use Land-cover of Rajsamand City using Landsat data with the help of LULC(Land use land cover) Map (1991-2021).

IV. DATA SOURCES AND RESEARCH METHODOLOGY

To create a land-use land-cover map for the specified study area, two Landsat images were obtained from the USGS (United States Geological Survey) earth explorer website. Each image has a resolution of 30 meters. The first image, captured by Landsat-5 on September 02, 1991, had no cloud cover. The second image, taken by Landsat-8 on December 19, 2021, also had zero percent cloud cover. Both images were acquired after the monsoon period. Each image possesses different band sets with resolution of 30 meters. In order to observe variations in Land use Land cover, a land-use land-cover map was generated using the Q-GIS open-source software. Image classification was performed using bands 1, 2, 3, 4, 5, 6, and 7. The semi-automatic classification plugin (Q-GIS) was utilized to apply a supervised classification technique. The study area was divided into Five main categories: Waterbody, Vegetation area, barren area, Mining area, and Built-up, as there were no significant additional land morphologies. Prior to classification, several pre-processing steps were performed on the image, including geometric rectification or image registration, radiometric calibration, and atmospheric correction. An accuracy assessment of the classification was also conducted.

V. RESULT AND DISCUSSION

LULC covering five major classes: Waterbody, Vegetation area, barren area, Mining area, and Built-up of 1991 and 2021 are shown in figure (3). The spatial distribution pattern of LULC obtained from supervised classification is enumerated in Table (1).

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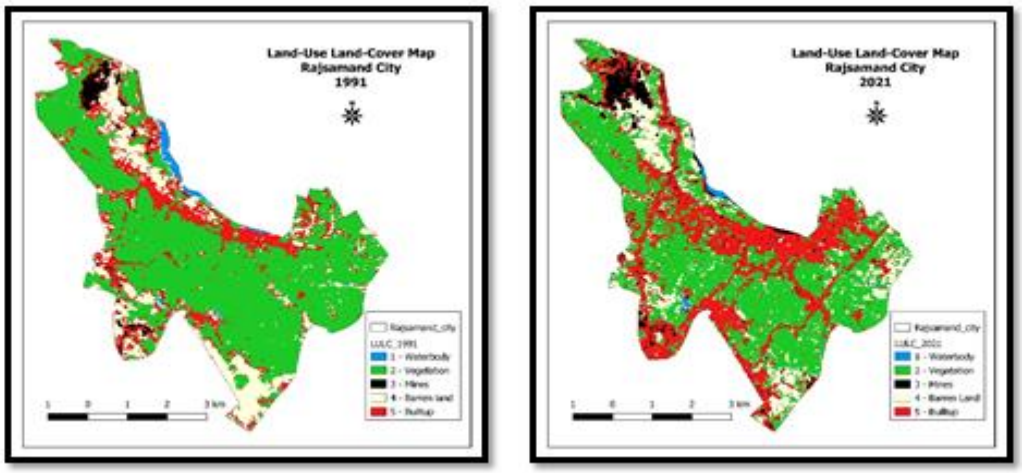

Fig 3 (LULC change in LULC Map during years 1991-2021 in Rajsamand City)

Table 1 LULC distribution in Rajsamand City				
Lulc class	1991		2021	
	Area (km²)	Area (%)	Area (km²)	Area (%)
Waterbody	0.44	1.24	0.17	0.47
Vegetation	22.98	63.84	17.74	49.28
Mining	0.78	2.16	1.87	5.20
Barren Land	5.69	15.80	5.28	14.67
Builtup	6.11 35.99	16.96 100.00	10.93 35.99	30.37 100.00

The results of the land-use land-cover (LULC) classification indicate a significant decrease in vegetation within the study area. The area covered by vegetation has decreased from 22.98 km² in 1991 to 17.74 km² in 2021. Conversely, there has been an increase in the Builtup area, with 4.82 km² of vegetation converting to Builtup area. These changes are visually evident in Figure 1.3, where the Red area appears much larger in the 2021 image compared to the 1991 image. Water body has also decreased as total area under water body changed from 0.44 km² to 0.17 km². While Mining area is increased from 0.78 km² to 1.87 km². The accuracy assessment of both images was conducted using the Kappa statistic. The 1991 image classification demonstrated an overall accuracy of 86.39 percent, indicating a high level of accuracy in classifying the land cover. Similarly, the 2021 image classification achieved an overall accuracy of 93.21 percent. This indicates that the classification process accurately represented the different land cover categories within the study area. Moreover, the user accuracy and individual producer accuracy for both the Vegetation and Builtup classes exceeded 95 percent. This indicates a high level of confidence in accurately identifying and distinguishing these land cover classes within the classification results of both images.

The results from Land Use/Land Cover (LULC) classification suggest exceptional urban sprawl in Rajsamand City. The fact that the city is developing itself along with the Rajsamand Reservoir indicates the lake's significance as a center of growth. Urban sprawl typically refers to the outward expansion of urban areas into surrounding rural or undeveloped lands. It often involves the conversion of agricultural or natural areas into urbanized zones, resulting in increased infrastructure, housing, and commercial developments.

In the case of Rajsamand City, the proximity and influence of the Rajsamand Reservoir seem to have played a role in its growth pattern. Water bodies can attract development due to their aesthetic appeal, recreational opportunities, and potential for tourism. The presence of a lake can contribute to the attractiveness and livability of a city, leading to increased urbanization in the surrounding areas. However, it's important to note that without access to specific data or studies on Rajsamand City's development, it's difficult to provide a comprehensive analysis. Factors such as population growth, economic drivers, government policies, and urban planning decisions can also contribute to urban sprawl. Local land use policies and regulations, as well as environmental considerations, should be taken into account to understand the full context of the city's growth and its relationship with the Rajsamand Reservoir.

VI. CONCLUSION

The study analyzed the changes in Land-use Land-cover in Rajsamand City from 1991 to 2021 using Landsat data. The findings of the study indicate a significant increase in urban areas over the past 30 years, accompanied by a decrease in vegetation, including agricultural land. The research highlights that there has been a reduction of 14.56 percent in the total vegetation cover, which includes agricultural areas, during this period. Additionally, the study reveals that the mining area has doubled over the same time span.

These observations suggest a transformation in the land-use pattern of Rajsamand City, with an expanding urban footprint at the expense of natural vegetation and agricultural land. The increase in mining activity also indicates potential impacts on the local environment and natural resources. It is important to consider the implications of these changes and their effects on ecosystems, biodiversity, and sustainable land management practices for the future development and planning of Rajsamand City.

REFERENCES

[1]. Amade, N., M. Painho, and T. Oliveira. 2018. "Geographic Information Technology Usage in Developing countries–A Case Study in Mozambique." Geo-Spatial Information Science 21 (4): 331–345. doi:10.1080/10095020.2018.1523995. [Taylor & Francis Online], [Web of Science ®], [Google Scholar]
[2]. BHATTA, Basudeb (2012). Urban Growth Analysis and Remote Sensing A Case Study of Kolkata, India 1980-2010, ISSN 2211-4173, Canada: Springer.
[3]. Cobbinah, P. B., and R. M. Darkwah. 2016. "African Urbanism: The Geography of Urban Greenery." Urban Forum 27 (2): 149–165. doi:10.1007/s12132-016-9274-z. [Crossref], [Google Scholar]
[4]. Dewan A.M., Yamaguchi Y. (2009) - Using remote sensing and GIS to detect and monitor land use and land cover change in Dhaka Metropolitan of Bangladesh during 1960-2005. Environ. Monit. Assess. 150: 237-249. http://dx.doi.org/10.1007/s10661-008-0226-5.
[5]. Hu, T., J. Yang, X. Li, and P. Gong. 2016. "Mapping Urban Land Use by Using Landsat Images and Open Social Data." Remote Sensing 8 (2): 2. doi:10.3390/rs8020151. [Crossref], [Web of Science ®], [Google Scholar]
[6]. Master Plan of Rajsamand City, (2010-2031) Urban Planning Department, Rajasthan.
[7]. Musakwa, W., and A. Van Niekerk. 2014. "Monitoring Urban Sprawl and Sustainable Urban Development Using the Moran Index: A Case Study of Stellenbosch, South Africa." International Journal of Applied Geospatial Research 5 (3): 1–20. doi:10.4018/ijagr.2014070101. [Crossref], [Google Scholar]
[8]. Terfa, B. K., N. Chen, X. Zhang, and D. Niyogi. 2020. "Urbanization in Small Cities and Their Significant Implications on Landscape Structures : The Case in Ethiopia." Sustainability 12: 1235. doi:10.3390/su12031235. [Crossref], [Web of Science ®], [Google Scholar]
[9]. U.S. Geological Survey 1991-2021, Landsat data https://earthexplorer.usgs.gov/