IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

SPATIO-TEMPORAL ASSESSMENT OF LAND USE LAND COVER CHANGES IN UDAIPUR CITY USING SATELLITE DATA

Hemlata Ojha, Department of Geography, Mahatma Jyoti Rao Phoole University, Jaipur

Abstract: Land use (such as agriculture, pasture, or plantation) describes human use of land, while land cover (such as forest or desert) describes the biophysical characteristics of the land surface. This study seeks to utilize remotely sensed data and GIS tools to analyze the LULC in Udaipur city, Rajasthan to detect changes in the area by comparing images between 1972 to 2020. For developing a Land-use Land-cover map for the study area, two images of the Landsat series have been collected from the USGS (United States Geological Survey) earth explorer website. Each image has a resolution of 30m. A supervised classification technique was used with the help of a semi-automatic classification plug-in(Q-GIS). The study area has been classified into five broad categories – Forest, Agriculture, built-up, scrubland, and waterbody. In pre-processing of the image geometric rectification or image registration, radiometric calibration and atmospheric correction have been applied. The study reveals that there is a major decline in forest cover and agriculture area in these years while Built-up area rapidly increased. 20.85 percent vegetation reduced in Fifty years of time.

Keywords: Land use land cover, remote sensing, GIS, Udaipur, Satellite data, Landsat

1. INTRODUCTION

Land is a important factor of production and throughout much of the sequence of human history. It has been strongly coupled with economic growth. Often improper land use is causing various forms of environmental degradation. The modification in any form of land use is mainly related either to external forces or the pressure built up within the system (Bisht and Kothyari, 2001)[1]. Monitoring land cover changes by means of satellite remote sensing has verified to be a good scientific technique in recent decades. Land use and cover change (LUCC) is the study of land surface area change. Land use (such as agriculture, pasture, or plantation) defines human use of land, while land cover (such as forest or desert) defines the biophysical characteristics of the land surface. Land-use change may affect land cover, while changing land cover may similarly affect land use. Research on LUCC is essentially multidisciplinary, attracting scientists from a range of fields, including but not limited to economics, sociology, geography, GIS Science (geographic information systems [GIS] and remote

[1] Bisht, B.S and Kothyari, B.P (2001): Land Cover Change Analysis of Garur Ganga Watershed Using GIS/Remote Sensing Technique. Journal of Indian Society of Remote Sensing, Vol. 29 (3): 165-174.

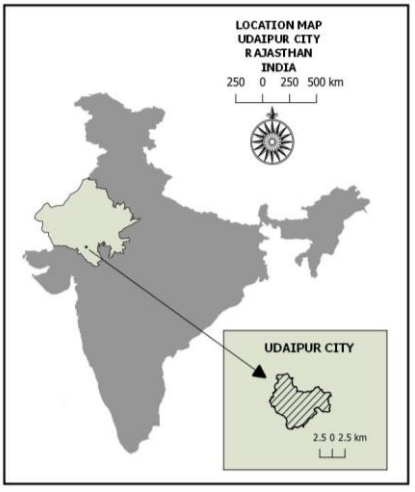
sensing in particular), and demography. More than double as much land globally (over 30 million square kilometers) is in usage as pasture and grasslands comparative to agricultural land. The mainstream of the latter is cultivated in crops to feed livestock or to fuel engines rather than to feed humans. While the best agricultural lands tend to be among the first wildlands transformed to agriculture, amplified agricultural expansion typically entails diminishing returns on agricultural yields. With agricultural land per capita declining in many parts of the world, despite cumulative demands for food, fuel, and fiber, LUCC remain the most noticeable expression of human profession across the earth's surface. How many people, living where, eating and consume what, and formed how and where designates the vast majority of these human-inscribed landscape dynamics. Change detection in remote sensing quantifies the change through analysis of variation in the spectral response of vegetation or another cover type that occurs at a given location (Sharma and Jalan, 2013)[2].

Various methods of LULC change detection analysis were discussed by Lu et al[3]. It is possible to establish a model to forecast the trends in land uses in a certain period through the study of past land-use changes, which could provide some basis for scientific and effective land-use planning, administration and ecological restoration in a study area and leadership for regional socio-economic development. Therefore, precise and up-to-date land cover change information is essential for understanding and measuring LULC changes. Remote sensing (R.S.) and geographic information system (GIS) are vital tools in gaining precise and timely spatial data of land-use and land-cover, as well as examining the changes in a study area.[4] Remote sensing images can effectively record land-use situations and deliver an exceptional source of data, from which updated L.U.L.C information and changes can be extract, analyzed, and simulated competently through certain means.[5] Therefore, remote sensing is extensively used in the recognition and monitoring of land use at different scales[6]. GIS provides a elastic environment for collecting, storing, displaying, and analyzing digital data necessary for change detection. This study seeks to exploit remotely sensed data and GIS tools to analyze the LULCC in Udaipur city, Rajasthan to detect changes in the area by comparing images between 1972 to 2020.

2. THE STUDY AREA

Udaipur which is known as the "The City of Lakes" is located in the southernmost part of Rajasthan- a North-Western state of India. It is surrounded by azure lakes and the southern end of the Aravalli range. The Aravalli range is a major solace feature of this city as it separates the scorching Thar Desert from the plains and plateaus of eastern Rajasthan. Udaipur city is located at 24°35" north latitude and 73°44' east longitude. The UMC (Udaipur Municipal Corporation) is the only Municipal Corporation in the Udaipur district and covered an area of 64 sq. km. At present, the city is separated into 55 wards (Fig.1). Udaipur city is the sixth-largest urban center in Rajasthan. The north-south extension is 18.5 km and the east-west extension is 27.5 km and its location along the major transport routes of the

Figure 1.1 location map



[2] Sharma, K. and Jalan, S. (2013): Change Assessment of Urban Green Spaces of Dehradun city Using Image Derived Parameters. Transactions, Journal of the Institute of Indian Geographers, Vol. 35: 63-72.

[3] Lu D, Mausel P, Brondízio E, Moran E. Change detection techniques. Int J Remote Sens. 2004;25(12):2365–401.

[4] Reis S. Analyzing Land Use/Land Cover Changes Using Remote Sensing and GIS in Rize, North-East Turkey. Sensors. 2008; 8(10):6188–202. https://doi.org/10.3390/s8106188 PMID: 27873865

[5] Pradhan B, Lee S, Mansor S, Buchroithner M, Jamaluddin N, Khujaimah Z. Utilization of optical remote sensing data and geographic information system tools for regional landslide hazard analysis by using binomial logistic regression model. J Appl Remote Sens. 2008; 2.

[6] Hua AK. Land Use Land Cover Changes in Detection of Water Quality: A Study Based on Remote Sensing and Multivariate Statistics. Journal of environmental and public health. 2017; 2017:7515130-.https://doi.org/10.1155/2017/7515130

country NH- 8 connecting Delhi-Mumbai, NH-76 towards Chittorgarh district, SH-9 and SH-32 connecting to Chittorgarh and Banswara districts. 2011, the population of Udaipur city is 4.5 million (4, 50,729 persons). The density of population in the city is 7,042 persons per square.

3. OBJECTIVE

1. To detect a change in Land use the land cover of Udaipur city using Landsat data with the help of LULC(Land use land cover) Map (1972-2020).

4. DATA SOURCES AND RESEARCH METHODOLOGY

For developing a Land-use Land-cover map for the study area, three images of the Landsat series have been collected from the U.S.G.S. (United States Geological Survey) earth explorer website. Each image has a resolution of 30m, first image is from Landsat 1 taken on 7 December 1972 with Zero percent cloud cover. The second image is from Landsat 5 taken on 11 October 1991 with Zero percent cloud cover and the last image from Landsat 7 was taken on 13 November 2020. All images have been captured after the Monsoon period. Both images have 30 m resolution for different band sets. To see the difference Land use Land cover map has been prepared in Q-GIS open-source software. Bands 2, 3, 4, and 5 were considered for image classification. A supervised classification technique was used with the help of a semi-automatic classification plug-in(Q-GIS). The study area has been classified into five broad categories – Forest, Agriculture, built-up, scrubland, and waterbody. In pre-processing of the image geometric rectification or image registration, radiometric calibration and atmospheric correction have been applied. Accuracy assessment of the classification has also been done.

5. Result and discussion

LULC covering five broad categories – Forest, Agriculture, built-up, scrubland, and waterbody of 1972,1991, and 2020 are shown in figure (1.2). The spatial distribution pattern of LULC got from the supervised classification is enumerated in Table (1.1).

Table 1.1 LULC 1972,1991,2020

		1972		1991		2020	
Color	**Classes Name**	**Area (Hect.)**	**% (Hect.)**	**Area (Hect.)**	**% (Hect.)**	**Area (Hect.)**	**% (Hect.)**
	Forest	19619.09	59.12	18700.07	56.35	12700.15	38.27
	Agricultural	6019.10	18.14	5800.60	17.48	4603.41	13.87
	Built-Up	2518.30	7.59	3200.21	9.64	10426.95	31.42
	Water Bodies/River	544.53	1.64	1670.31	5.03	1501.41	4.52
	Scrub Land	4484.92	13.51	3814.75	11.50	3954.02	11.91
Total		**33185.94**	**100.00**	**33185.94**	**100.00**	**33185.94**	**100.00**

According to the image analysis, total area of Udaipur city is 33185.94 hectare. Results displays that, in classified LULC map Forest has been degraded very badly in the city, in 1972 city has forest cover of 19619.09 ha which has been declined to 18700.07 and now in 2020 it has come to 12700.15 ha which is only 38.27 percent of total geographical area. Agriculture is also declined especially near suburb area; it has now converted to residential

land. In 1972 agriculture is 18.14 percent of total geographical area which came down to 17.48 percent in 1991 and in 2020 it remains 13.8 percent. Built up area has gone upwards as Secondary and tertiary economic activities are increasing in the north-eastern parts of Udaipur city. The maximum minerals activities and small-scale industries are located in the north and north-eastern directions (i.e. Amberi, Sukher, Shobhagpura, Raghunathpura and Bhuwana). The growth of the Udaipur city in the eastern direction is due to the availability of plain areas. Therefore, all new developmental activities are coming up in the particular areas like, Bhuwana, Dabok road and city's peripheral areas in the form of planned and unplanned way. Udaipur is also developing sectoral way along NH8 to Ahmedabad and NH76 to Chittorgarh. Thus, major development activities in the city have increased near water bodies and highways of Udaipur. The total built up in 1972 is 2518.30 ha which is 7.59 percent of total geographical area. But with rapid urbanization it is now 31.4 percent (10426.95 ha) of total land area. Urban areas are located in highly productive cropland areas, whereas new cropland mainly comes at the cost of forest and other natural area. In the study area both Forest and agricultural land convert to Urban land, which is a very big problem in the city. This process is usually irreversible. This rapid urbanization may also introduce health issues, insufficient houses, over-crowd, transportation, sanitation, water shortage, thrash disposable, educational, employments, crime, environmental, land degradation, poor infrastructure and pollution and the major among them is the lifelong threat to agricultural land.

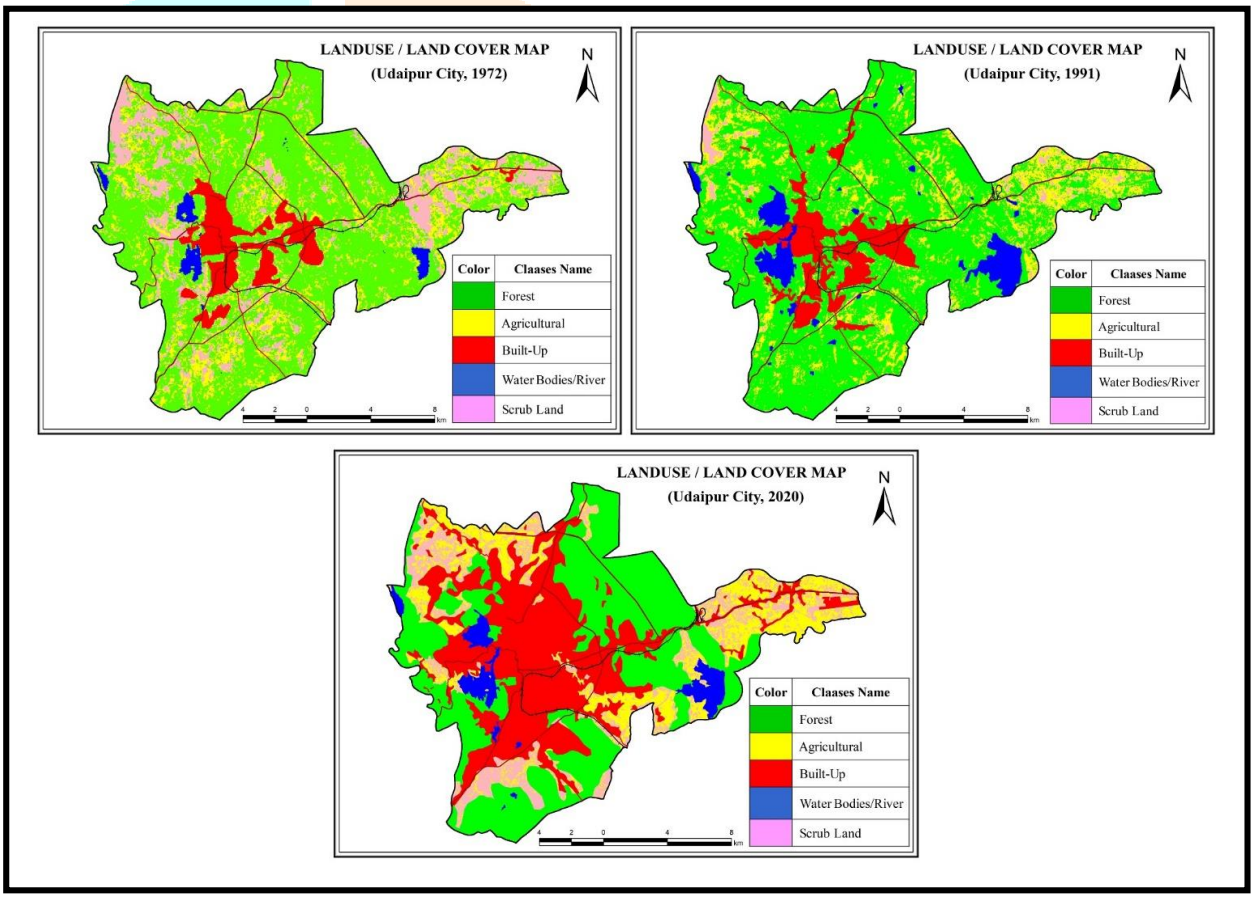


Figure 1.2 Land use land cover map of Udaipur city

Accuracy assessment of all images has been also done, in which overall accuracy was found 87.39 percent in 1972 image classification and for 1991 and 2020 image classification overall accuracy was found 92.21 percent and 95.23 percent, respectively.

6. Conclusion

This study assessed the change in LULC during 1971-2020 in the Udaipur city using Landsat data. The study discloses that there is a major decline in forest cover and agriculture area in these years while Built-up area rapidly increased. 20.85 percent vegetation reduced in Fifty years of time. This data suggest that Udaipur city may face health issues, insufficient houses, over-crowd, transportation, sanitation, water shortage, thrash disposable, educational, employments, crime, environmental, land degradation, poor infrastructure and pollution in near future. It needs to protect its natural area.

References

1. Bisht, B.S and Kothyari, B.P (2001): Land Cover Change Analysis of Garur Ganga Watershed Using GIS/Remote Sensing Technique. Journal of Indian Society of Remote Sensing, Vol. 29 (3): 165-174.
2. Sharma, K. and Jalan, S. (2013): Change Assessment of Urban Green Spaces of Dehradun city Using Image Derived Parameters. Transactions, Journal of the Institute of Indian Geographers, Vol. 35: 63-72.
3. Lu D, Mausel P, Brondízio E, Moran E. Change detection techniques. Int J Remote Sens. 2004;25(12):2365–401.
4. Reis S. Analyzing Land Use/Land Cover Changes Using Remote Sensing and GIS in Rize, North-East Turkey. Sensors. 2008; 8(10):6188–202. https://doi.org/10.3390/s8106188 PMID: 27873865
5. Pradhan B, Lee S, Mansor S, Buchroithner M, Jamaluddin N, Khujaimah Z. Utilization of optical remote sensing data and geographic information system tools for regional landslide hazard analysis by using binomial logistic regression model. J Appl Remote Sens. 2008; 2.
6. Hua AK. Land Use Land Cover Changes in Detection of Water Quality: A Study Based on Remote Sensing and Multivariate Statistics. Journal of environmental and public health. 2017; 2017:7515130-. https://doi.org/10.1155/2017/7515130