



## CHANGE DETECTION IN LAND USE LAND COVER: A CASE STUDY OF HYDERABAD CITY

**Mounika T**

Department of geography, Sri Krishnadevaraya University Anantapuramu

**A. Krishna  
Kumari**

Department of geography, Sri Krishnadevaraya University Anantapuramu

**ABSTRACT** Urbanisation has become the global phenomena in the present century. Continuous removal of green spaces and the growth of urban heat islands, abrupt and unsustainable changes in land use land cover have been taken place all over the urban areas of India. Hyderabad, the capital of Telangana state is one such urban area. The city is experiencing fast growth and has more prospects in many of the urban activities. Due to the expansion of unsustainable economic activities, rise in vehicular traffic, poor water supply and sewage facilities etc., the city is plagued with urban environmental issues. To address these issues and to formulate suitable plans, periodical LULC studies are very much needed. Hence in the present study an attempt is made to study the land use changes in Hyderabad city between 1991 and 2021 using RS & GIS techniques.

**KEYWORDS :** Land use, Land cover, Change detection, Urban areas.

### Introduction and Review of Literature:

The shift in land use and land cover is a result of natural and socio economic factors, as well as how people have used on them over time and space. Changes in land use and land cover (LULC) are primarily influenced by population growth, both positive and negative, economic growth, and physical variables such as terrain, slope, soil type and climate. Changes in land use alter the availability of many resources, such as water, soil and vegetation. The amount of evapotranspiration, groundwater infiltration and surface runoff are directly influenced by changes in land use. Considering global dynamics and how they respond to environmental and socio economic causes, land use and land cover change has become a crucial subject. On global and local level, changes in land use and land cover have negative impact on climatic patterns, natural disasters, and socio economic dynamics. For the planning of sustainable land resource management and in understanding the changes of hydrological processes, information on land use/land cover are very useful and significant.

GIS and Remote sensing technology were employed by many scholars to conduct Land use and Land cover research among them, Kavitha N et al examined Land use/Land cover changes in Nellore district in 2008; Nonngkynrih et al attempted to study urban sprawl analysis of Kohima town using multi temporal remote sensing data in 2008; In 2010 Parth S R & Arijit R provided an intricate analysis of the changes in land use and land cover through the utilization of Remote Sensing and GIS techniques; Sandhya Jain & S. kumar studied settlements mapping in the year 2010; Hafez A. Afify conducted a case study in Burg El-Arab area to evaluate the change detection techniques for monitoring land cover changes in the year 2011; A case study was conducted by aswini K M & Umakant R in Delhi on urban change detection using Remote Sensing and GIS in the year 2019; Vineet K R & Gayatri R attempted to study land use changes in Ghazipur district(Uttar Pradesh) in 2019; In 2019 Roohifatma & vandana K C assessed how urban sprawl in Unnao town, Uttar Pradesh, was transforming the land; Padmaja S & Kaushalya R conducted a case study of the Hyderabad city region on pressure, state, response in a Growing metropolis in the year 2019; A case study was conducted by Shoukat Ali Shah & Mdheeha Kiran on GIS-Based technique of land use and land cover change detection in taluka Mirpur mathelo, Ghotki district, Pakistan in the year 2021.

### Study area:

The Municipal Corporation of Hyderabad is located on the northern latitude of 17.366°N and eastern longitude of 78.476°E with a total geographical area of 178.18 sq. km. In 2007 the Municipal Corporation of Hyderabad was expanded and reorganised in to Greater Hyderabad Municipal Corporation (GHMC) with a total area of 650 Sq. Km. In the present analysis, the municipal corporation of Hyderabad (MCH) has been considered as the study area both in 1991 and 2021 (Fig1). The average height of the city is 540 mts above mean sea level. According to 2011 census, the total population of the city is 6,809,970 with a density of population 18172 persons per sq. km.

Hyderabad is one of the cities of India with greater population growth and has potential to become the cyber capital of India. Yet the city's most pressing problems are shortage of water, ground water depletion, contamination of water bodies due to industrial effluents and sewage water, loss of green cover, housing congestion, air and noise pollution, illegal occupation of lakes and other water bodies, submergence due to rainwater etc. Hence the study area has become environmentally more vulnerable city. To understand and address these issues, periodical studies on LULC are very much needed and helpful.

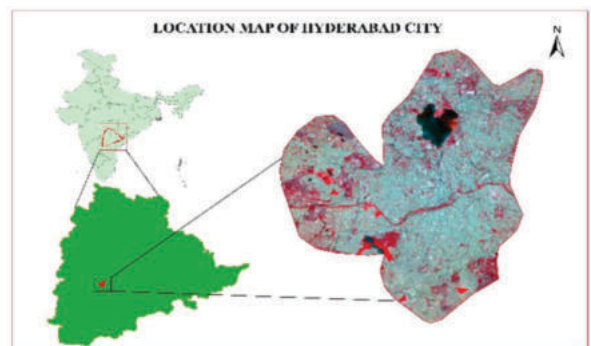


Fig-1

### OBJECTIVES:

The following are the objectives of the present study

- To map land use and land cover classes of Municipal Corporation of Hyderabad for 1991 & 2021.
- To determine land use land cover changes for 1991 & 2021.
- To check the NDVI and vegetation index for 1991 & 2021.

### Data:

Temporal LANDSAT imageries were taken in order to detect changes for the study period 1991 & 2021. To study Land use, land cover and change detection, two cloud-free photos were collected from LANDSAT 8-9 OLI/TIRS in 2021 and LANDSAT 4-5 TM in 1991.

Free downloading of satellite pictures has been done from the USGS Earth Explorer Earth Resource Observation System data centre (Fig 2&3). The examination of the imageries for the years 1991 to 2021 encompassed all visible and infrared bands with the exception of thermal infrared.

### METHODOLOGY:

In the present study Remote sensing & GIS techniques were used to analyse the land use and land cover change detection in Hyderabad city. The tools like maximum likelihood classification technique was utilised for supervised classification in Arc GIS. To study the green cover in the study area normalised difference vegetation index (NDVI) is applied. ArcGIS 10.4.1 software is used for mapping and analysing the data.

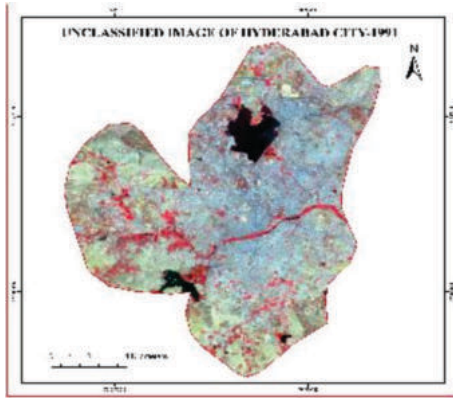


Fig-2

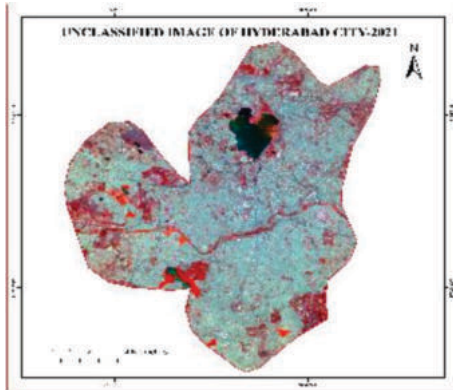


Fig-3

**RESULTS AND DISCUSSION:**

**Classification of Satellite Imageries**

The total demarcated area of Hyderabad city for the study is estimated as 178.18 sq.km ( Table-1). During 1991 it is analysed that 3.6% area was under water bodies, 11.7% under vegetation, 32.92% under barren land and the remaining 51.69% of area was under settlements. For the year 2021, the image analysis reported that there is only 2.79% area under water bodies, 7.42% under vegetation, 15.75% under barren land and 74.03% of area under settlements (Fig 4&5).

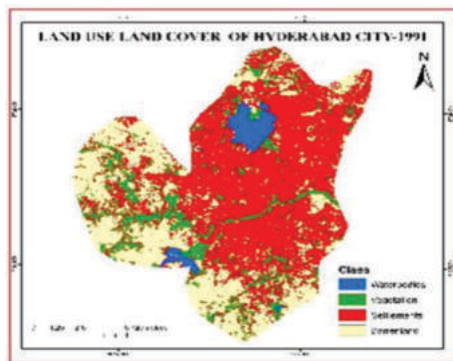


Fig-4

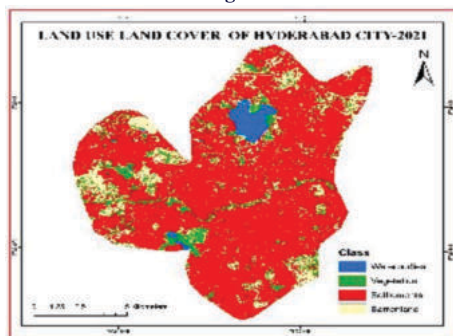


Fig-5

CLASS	1991	2021	CHANGES DURING 30 YEARS PERIOD			
	AREA IN Sq.Km	AREA IN %	AREA IN Sq.Km	AREA IN %	AREA IN Sq.Km	AREA IN %
Waterbodies	6.54	3.6	4.97	2.79	-1.57	- 0.81%
Vegetation	20.86	11.7	13.22	7.42	-7.64	- 4.28%
Barren land	58.66	32.92	28.06	15.75	-30.6	-17.17 %
Settlements	92.11	51.69	131.91	74.03	39.8	22.34%
Total	178.18	100	178.18	100	-	-

The changes during the 30 years period are similar to any other urban areas. Decrease in area is observed in water bodies, vegetation/green cover and barren land and increase in only settlements area. There is a shrinkage of 1.57 sq.km (0.81%) area in water bodies, significant decrease of 7.64 sq.km (4.28%) area in vegetation/ green cover and contraction of 30.6 sq.km of area (17.17%) in barren lands is reported in Hyderabad city. Remarkable amount of 39.8 sq.km area (22.34%) is increased in the category of settlements during the three decades in the study area. The decadal land use/ land cover categories and changes that took place have been depicted in Fig 6.

The change detection among different categories of LULC is quite evident from Table-2 during the study period 1991 and 2021. Maximum change has been taken place in barren land changed to settlements (41.55 sq.km), followed by vegetative land to settlements (11.01 sq.km), settlement area to barren land (9.65 sq.km), vegetative land to barren land (4.17 sq.km), settlements to vegetative land (3.2 sq.km), barren land to vegetative land (2.96) and water bodies to vegetative land (1.55 sq.km). Minimum amount of change is noticed in water bodies to settlement area (0.26 sq.km) followed by vegetative land to water bodies (0.17 sq.km), settlements area to water bodies (0.17 sq.km), water bodies to barren land (0.14 sq.km) and barren land to water bodies with only 0.04 sq.km of area during the study period. This change in land use and land cover is due to increase in the population. There were 4,386,000 people living in Hyderabad city in 1991, and there are 10,269,000 people there in 2021, an increase of 5,883,000 number of people. More than twice has increased from 1991 to 2021.

About 79.1 sq.km of area under settlements has not changed during the 30 years period. Similarly, about 14.11 sq.km of barren land followed by 5.51 sq.km of vegetative land, 4.6 sq.km of water bodies area also seemed stationary during the three decades of study period.

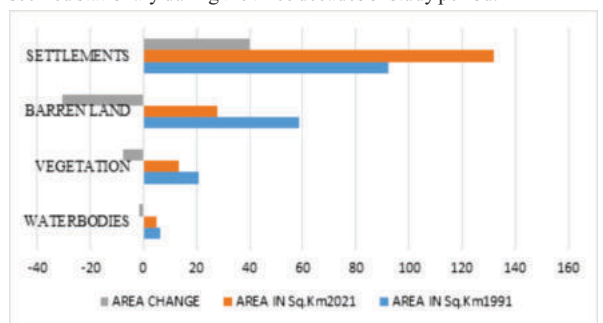


Fig-6

CHANGE	AREA CHANGE IN Sq.Km
Barren land -Waterbodies	0.0405
Waterbodies -Barren land	0.1413
Settlements -Waterbodies	0.1692
Vegetation -Waterbodies	0.1692
Waterbodies -Settlements	0.261
Waterbodies -Vegetation	1.5462
Barren land -Vegetation	2.9691
Settlements -Vegetation	3.204
Vegetation -Barren land	4.1742
Waterbodies -Waterbodies	4.5963

Vegetation -Vegetation	5.508
Settlements -Barren land	9.6453
Vegetation -Settlements	11.0088
Barren land -Barren land	14.1084
Barren land -Settlements	41.5467
Settlements -Settlements	79.0983
Total	178.1865

#### NDVI of Hyderabad City for 1991 & 2021:

The NDVI analysis values for the Hyderabad city during 1991 and 2021 have been calculated as 0.62 and 0.5 (Fig 7&8). The NDVI values normally ranges from 0-1. If the index value is '0' it is classified as bare soil or water body, if the value is less than 0.2 or equal to 0.2 it is stated as very low vegetation, 0.2 to 0.4 with low vegetation, 0.4 to 0.6 with moderately low vegetation, 0.6 to 0.8 moderately high vegetation and 0.8 to 1 index value represented as high vegetation cover. Hence based on the NDVI values of the study area the vegetation is moderately high in the year 1991, and moderately low in the year 2021. The NDVI values revealed that, in the study area, the vegetation/green cover slided down from first category to third category descendingly, which is to be considered as an alarm by the planners and policy makers. Replacement of non-green patches or development of new green spaces are very much important for the sustainability of city development.

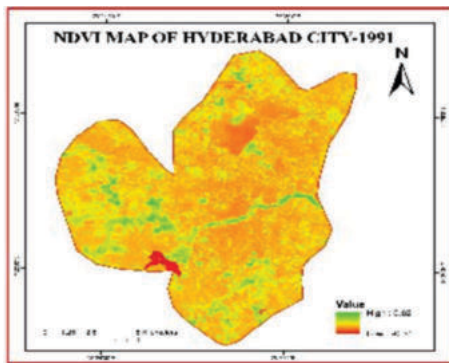


Fig-7

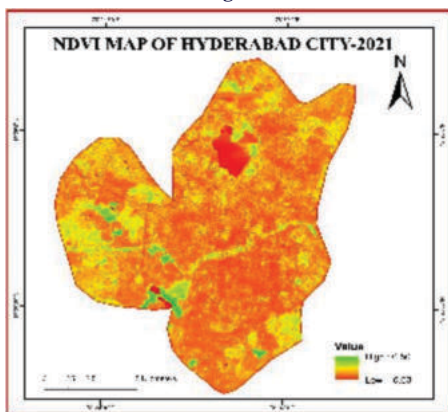


Fig-8

#### CONCLUSION:

The aim of this study is to provide changing patterns of land use and land cover in Hyderabad city between the years 1991 and 2021. The findings of the analysis are intriguing. The settlements area has had a total positive change of 39.79 Sq.km (22.34%) between 1991 and 2021. The increase in this category is due to people's migration from villages to cities for employment and other reasons. The amount of barren land decreased by 30.6 Sq.km (17.17%) which has been diverted to settlements. Shrinkage of area is also noticed in waterbody area with 1.57 Sq. km (-0.81%) and vegetated land with 7.64 Sq.km (-4.28%).

#### REFERENCES:

1. Aswini Kumar Aswath & Umakant Rawat (2019), Urban change detection using Remote sensing and geographical information system: A case study of Delhi region, India. Annals, NAGI Volume 39 (No. 2) , 311-319.
2. Hafez A. Afify (2011), Evaluation of change detection techniques for monitoring land cover changes, A Case study in Burg El-Arab area, Alexandria Engineering Journal, Volume 50, Issue 2, 187-195.

3. Kavitha, N, M. Jayanthi and M. Sakthivel, (2008), Land use/Land cover changes in Nellore District. Article in The Indian Geographical Journal, volume 82 (No.1), 60-66.
4. Nongkynrih, Jenita. M & N. Hiese, (2008), Urban sprawl analysis of kohima town using multi-temporal remote sensing data, The Deccan geographer, volume 46 (No.1) , 33-38.
5. Padmaja, S & Kaushalya ramachandran (2019), Pressure, State, Response in a growing metropolis - Acase study of Hyderabad city region, Annals, NAGI, Volume 39 (No.2), 174-189.
6. Parthasarathi roy & Arijit roy, (2010), Land use and Land Cover change in India: A Remote Sensing & GIS perspective, Article in journal of the Indian institute of science, volume 90, Issue 4, 489-502.
7. Roohifatma & Vandana Kumari Chouhan. (2019), An Assessment of land transformation due to urban sprawl in Unnao Town, Uttar Pradesh, Annals, NAGI volume 39 (No.2), 231-239.
8. Sadhana Jain & Swadesh Kumar, (2010), A study of settlements mapping by using high resolution for disaster mitigation and rehabilitation, The Deccan Geographer, volume 48 (No.1) , 31-39.
9. Shoukat Ali shah & Mdheeha Kiran (2021), A GIS-Based technique analysis of Land use and land cover change detection in taluka Mirpur mathelo: A case study in district Ghotki, Pakistan, Article in International Advanced Researchers and Engineering Journal, volume 5, Issue 2, 231-239.
10. Vineet Kumar Rai & Gayatri Rai. (2019), Land use changes in Ghazipur district (Uttar Pradesh): A Geographical Analysis, Annals, NAGI, volume 39 (No. 2), 212-230.