iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** IV **Month of publication:** April 2018

DOI: http://doi.org/10.22214/ijraset.2018.4790

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue IV, April 2018- Available at www.ijraset.com

Assessment of Changes in the Land Use and Land Cover Pattern using Matrix Union Method: A Case Study of Cuddalore District, Tamil Nadu, India

Ravikumar P[1], Dr. G. Bhaskaran [2]
[1]*Ph.D Research Scholar, University of Madras, Chennai*
[2]*Assistant Professor, University of Madras, Chennai*

Abstract: The surface of the earth is experiencing rapid land-use/land-cover changes due to various socioeconomic activities and natural phenomena. The main aim of this study was to gain a quantitative understanding of land use and land cover changes in Cuddalore District over the period 2005- 2015. Supervised classification-maximum likelihood methos in ERDAS imagine was used for assigning each pixel to detect LULC which were observed in Cuddalore District using multispectral satellite data derived from Landsat for the years 2005, 2008, 2010 and 2015 respectively. The District was classified into six major LU/LC classes viz. Built up areas, Agricultural land, water bodies, forests, fallow land and waste-land. Change detection analysis was performed using matrix union method to compare the quantities of land cover class conversions between time intervals. There were both increase and decrease of the different LULC classes from 2005 to 2015, due to urbanization and various climatic factors. There were substantial shifts from some classes to others. The observed changes ranged from Climatic factors such as rainfall and drought to socio-economic factors. LULC mapping should be carried out consistently, in order to quantify and characterize LULC changes. This will be useful in establishing trends and enabling resource managers for the projection of realistic change scenarios for natural resource management.
Keywords: matrix union, land cover, supervised classification, change detection

I. INTRODUCTION

The last few centuries have witnessed a drastic change in the land cover of the earth as human beings have been altering the face of the earth for the last few centuries, especially with the introduction of machines. The argument about the relationship between human population dynamics and the availability of natural resources dates back to more than 200 years when Malthus (1798) puts forward his statement that population growth would eventually outstrip the production capacity of the land. It was only in the second half of the 20th century when the probability of the Malthusian projection seemed to be a reality, that sincere efforts to study the human population–environment relation were undertaken.

One of the main natural resources of a country is land. Any city population but also by changes in spatial dimensions. Land use change, including land conversion from one type to another and land cover modification through land use management, has greatly altered a large proportion of the earth's land surface to satisfy mankind's immediate demands for natural resources (Meyer and Turner 1992; Vitousek et al. 1997; Foley et al. 2005). In most developing countries, the increase in the rate of urbanization and the rapid population growth have many adverse effects such as, conversion of agri and forest land into settlements, excessive growth of industries, etc. India is also a victim such evils. For performance of human activities, urban Land is considered as one of the significant resources. Extension and development of cities are one of the reason, which vanishes the water bodies in huge number (Chandrasekar V, 2017).

II. STUDY AREA

The district has an area of 3,564 km². It is bounded on the north by Villupuram District, on the east by the Bay of Bengal, on the south by Nagapatinam District, and on the west by Perambalur District. The district is drained by Gadilam and Pennaiyar rivers in the north, Vellar and Kollidam River (Coleroon) in south. The production of cashew nut and jack fruit from this district contributes considerably to the state. In the year 2015 Flood, Cuddalore district was among those most severely affected by the flooding. Six of the district's 13 blocks suffered extensive damage during the floods in November. Heavy rainfall from 1 December in the district displaced tens of thousands of people. Rains continued through 9 December. Large swaths of Cuddalore city and the district remained inundated as of 10 December, with thousands of residents marooned by floodwaters and over 60,000 hectares of farmland inundated; over 30,000 people had been evacuated to relief camps

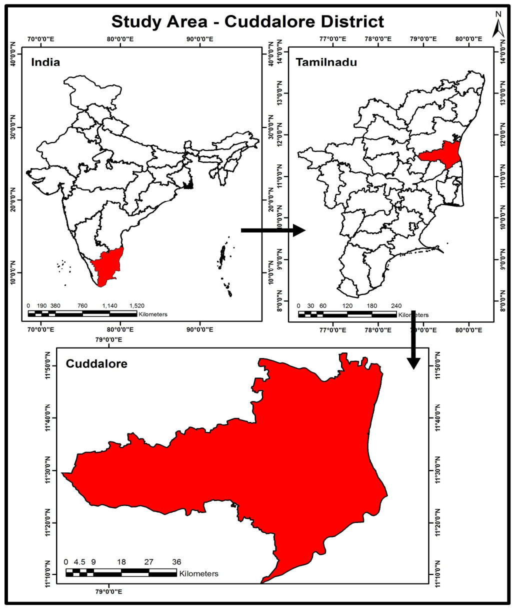


Figure 1: Study Area – Cuddalore District

A. *Aim & Objectives*

To Study the pattern of Landuse and Landcover changes in Cuddalore District.

B. *Objectives*

1) To study the Landuse and Landcover changes for the years 2005, 2008, 2010, 2015.
2) To Analysis change detection using Matrix Union Method

III. METHODOLOGY

S. No	Acquisition Date	Source	Resolution (m)	Path/Row
1	2005	Earth Explorer	30	142/52 & 143/52
2	2008	Earth Explorer	30	142/52& 143/52
3	2010	Earth Explorer	30	142/52& 143/52
4	2015	Earth Explorer	30	142/52& 143/52

Table 1: Data Source

A. *Data Collection*

Two types of data were used in this research. Satellite data that comprised of four years multi- temporal satellite imageries (LANDSAT imageries of 2005, 2008, 2010 and 2015) acquired from the Earth Explorer website (Table 1). Additional data included the ground truth verification data for the LU/LC classes. The ground truth data was in the form of reference points collected using Geographical Positioning System (GPS) for the 2015 image analysis, used for image classification and overall accuracy assessment of the classification results. The acquired Landsat images were processed by ERDAS imagine for geo-referencing, mosaicking and sub-setting of the image.

A number of field visits were undertaken for ground-truth verification and enabled in establishing the main land use land cover types. The Maximum Likelihood Classification is the most widely used per-pixel method for landuse landcover changes. The delineated LU/LC classes were; built up areas, water bodies, agriculture lands, forests, waste lands, fallow lands.

B. *Post Classification*

In the derived supervised classification, refinement is done to improve classification accuracy and reduction of misclassifications. After classification, ground verification was done in order to check the precision of the classified LU/LC map. Based on the ground verification necessary correction and adjustments were made. The map from of year 2005 was compared with the map produced at 2008 and a complete matrix of categorical change obtained and 2008 and 2010, 2010 and 2015 so on.

IV. LANDUSE AND LAND COVER CHANGE DEDUCTION

A. LULC change between 2005 and 2008

80.1%, 59.6% ,15.9%, 38.5% ,40.6% and 78.4% of land under water bodies, Agriculture land, Settlements, Wasteland, fallow land and Forest cover respectively in 2005 remained under the same LULC categories in 2008. There were notable conversions in the land cover categories within the same period. There were significant conversions from Agriculture land to fallow land (49.6%) and fallow land to waste land (39.8%). 36.6% of fallow land into settlements and 32.8% of fallow land changed into agriculture land.

B. Change detection between 2008 and 2010: The second comparison made during 2005 to 2010.

46.4%, 68.4% ,20.6%, 41.2% ,49.8% and 71.7% of land under water bodies, Agriculture land, Settlements, Wasteland, fallow land and Forest cover respectively in 2008 remained under the same LULC categories in 2010. There were notable conversions in the land cover categories within the same period. There were significant conversions from Agriculture land to fallow land (42.8%) and settlements (40.6%) and waste lands (37.8%).

C. Change detection between 2010 and 2015: The third comparison made during 2010 to 2015.

56.9%, 64.5% ,9%, 31% ,42.6% and 79.7 % of land under water bodies, Agriculture land, Settlements, Wasteland, fallow land and Forest cover respectively in 2010 remained under the same LULC categories in 2015. There were notable conversions in the land cover categories within the same period.. There were significant conversions from Agriculture land to settlements (47%) and fallow land (44.3%) and waste land (38%).

Land use and land cover analysis

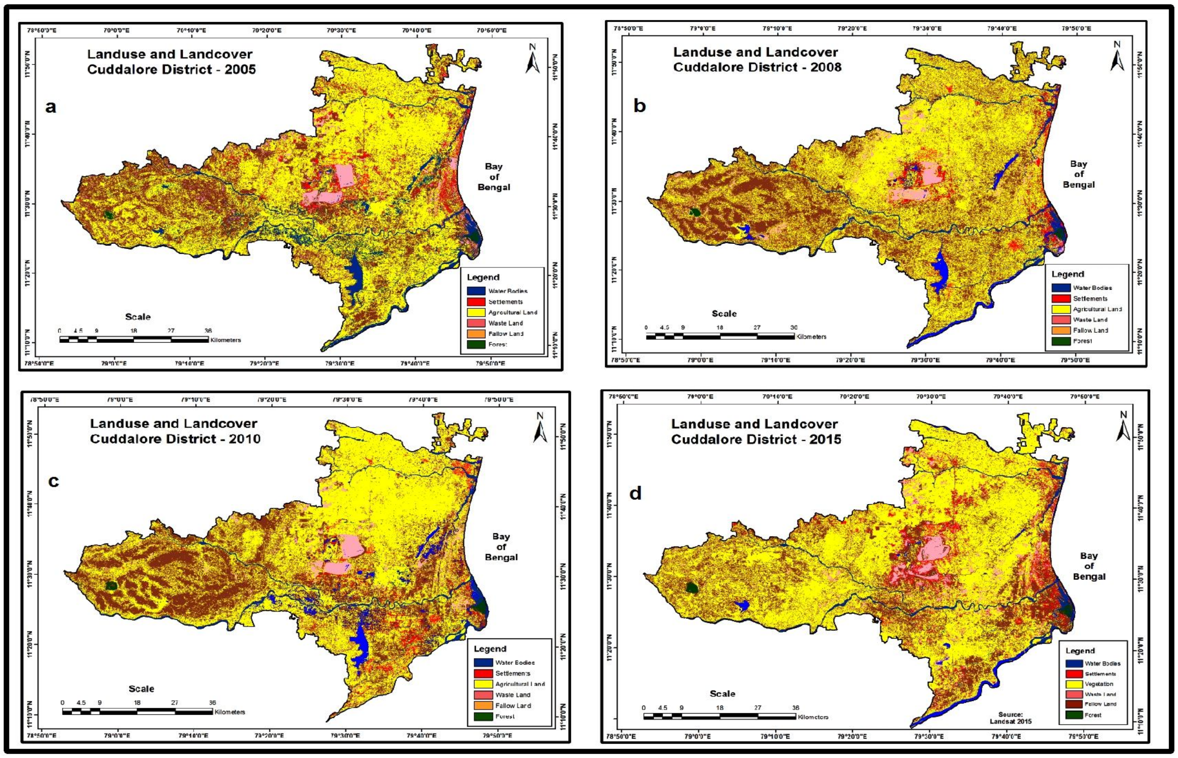


Figure 2: Landuse and Landcover – Supervised Classification

The result of this study showed that Agriculture land, settlements, waste land and forest increased from 2086.5 km2, 101km2, 186.3 km2 and 21.4km2 in 2005 to 2319.2 km2, 172.9 km2, 235.1km2 and 12.7 km2 in 2016 respectively in 2015.

But water body and fallow land decreased during this period from 255.2km2 and 1045.7km2 in 2005 to 93.7km2 and 862.8 km2 in 2015. These changes took place at the expense of other LU/ LC classes as seen in the change detection matrices (Tables). LU/LC changes are complex and are interrelated in a way that the expansion of one LU/LC type occurs at the expense of other LU/ LC classes. The results of this study agrees with the results of other studies.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue IV, April 2018- Available at www.ijraset.com

Landuse and Landcover				Area in Sq Kms	
S.No	Landuse and Landcover	2005	2008	2010	2015
1	Water Bodies	253.2	122.2	253.2	93.7
2	Agricultural Land	2006.0	2012.6	2006.0	2219.7
3	Settlements	101.0	96.4	101.0	170.9
4	Waste Land	176.3	162.0	176.3	235.1
5	Fallow Land	1005.9	1161.8	1005.9	831.8
6	Forest	21.5	9.0	21.5	12.8

Table 2: Landuse and Landcover Area

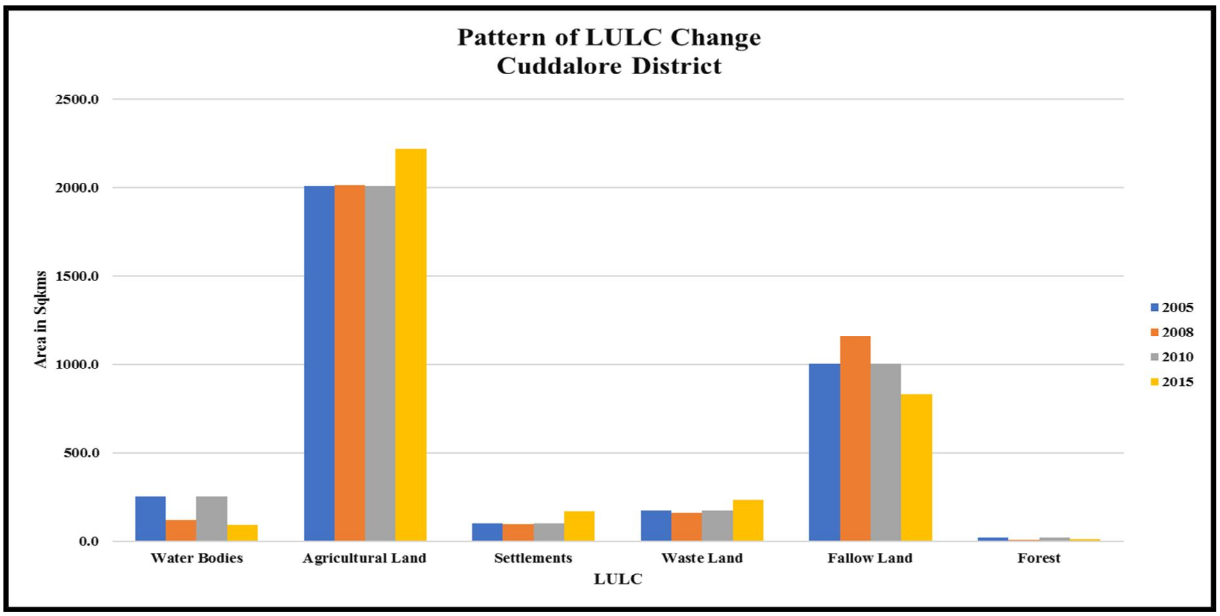


Figure 3: Landuse and Landcover Area

Change Detection using - Matrix Union Method

	LULC Type	Water Bodies		Agricultural Land		Settlements		Waste Land		Fallow Land		Forest	
		Area (Sq Km)	% Area	Area (Sq Km)	% Area	Area (Sq Km)	% Area	Area (Sq Km)	% Area	Area (Sq Km)	% Area	Area (Sq Km)	% Area
	Water Bodies	411.2	80.1	108.1	2.2	9.0	5.8	6.4	1.4	140.5	4.7	0.87	9.4
	Agricultural Land	58.6	11.4	2972.9	59.6	26.6	17.1	82.4	17.4	1469.9	49.6	0.76	8.2
2005	Settlements	2.5	0.5	63.2	1.3	24.6	15.9	13.6	2.9	29.8	1.0	0	0.0
	Waste Land	7.0	1.4	192.2	3.9	37.7	24.3	181.8	38.5	112.9	3.8	0.09	1.0
	Fallow Land	32.3	6.3	1637.7	32.8	56.7	36.6	188.2	39.8	1201.9	40.6	0.28	3.0
	Forest	1.6	0.3	11.5	0.2	0.4	0.3	0.1	0.0	8.6	0.3	7.24	78.4
	Total	513.12	100	4985.6	100	154.99	100	472.439	100	2963.58	100	9.24	100
						2010							
	LULC Type	Water Bodies		Agricultural Land		Settlements		Waste Land		Fallow Land		Forest	
		Area (Sq Km)	% Area	Area (Sq Km)	% Area	Area (Sq Km)	% Area	Area (Sq Km)	% Area	Area (Sq Km)	% Area	Area (Sq Km)	% Area
	Water Bodies	81.6	46.4	46.1	2.2	2.9	2.9	6.0	3.2	25.6	2.2	2.7	14.3
	Agricultural Land	44.1	25.1	1415.6	68.4	39.7	40.6	69.7	37.8	491.7	42.8	4.9	25.9
2008	Settlements	5.9	3.3	37.5	1.8	20.1	20.6	8.3	4.5	28.6	2.5	0.5	2.5
	Waste Land	1.5	0.9	55.8	2.7	2.5	2.6	76.0	41.2	30.1	2.6	0.2	0.8
	Fallow Land	42.4	24.1	515.5	24.9	32.5	33.3	24.4	13.2	572.0	49.8	2.8	14.8
	Forest	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.1	7.9	41.7
	Total	175.73	100	2070.562	100	97.626	100	184.5	100	1149.11	100	18.91	100
						2015							
	LULC Type	Water Bodies		Agricultural Land		Settlements		Waste Land		Fallow Land		Forest	
		Area (Sq Km)	% Area	Area (Sq Km)	% Area	Area (Sq Km)	% Area	Area (Sq Km)	% Area	Area (Sq Km)	% Area	Area (Sq Km)	% Area
	Water Bodies	53.33	56.9	69.34	3.0	5.19	3.0	9.54	4.1	37.72	4.4	0.48	3.8
	Agricultural Land	21.19	22.6	1495.99	64.5	81.23	47.0	89.4	38.0	382.3	44.3	0.46	3.6
2010	Settlements	1.719	1.8	32.76	1.4	15.55	9.0	8.44	3.6	39.16	4.5	0.005	0.0
	Waste Land	3.16	3.4	51.84	2.2	22.59	13.1	72.99	31.0	33.9	3.9	0.04	0.3
	Fallow Land	13.16	14.0	664.16	28.6	48.033	27.8	54.31	23.1	367.86	42.6	1.6	12.5
	Forest	1.14	1.2	4.95	0.2	0.32	0.2	0.48	0.2	1.86	0.2	10.18	79.7
	Total	93.699	100	2319.04	100	172.913	100	235.16	100	862.8	100	12.765	100

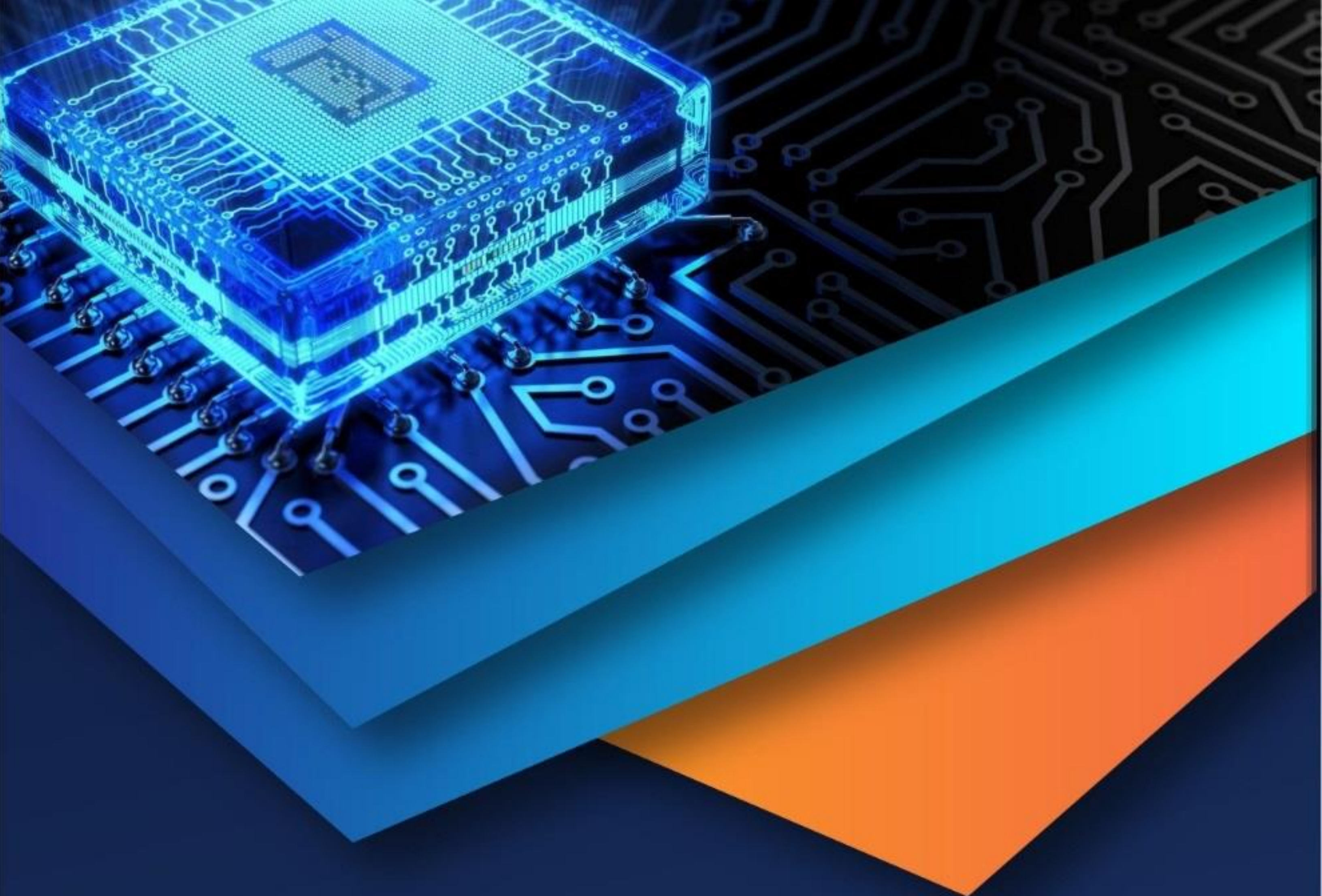
Table:3 Matrix Union

V. CONCLUSION

In this work, it was confirmed that the supervised classification of multi-temporal satellite images is an effective tool to analyze current land use as well as to detect changes in a changing environment. The selected Landsat images of 2005, 2008, 2010 and 2015 were used for the supervised classification. The changes varied from one LULC class to another with some maintaining a continuous change (increase or decrease) over the analysis period of (2005-2008, 2008-2010 and 2010-2015). Some classes got decrease in the first period and an increase in the second period and vice versa was true for other LULC categories. This study proves that multi-temporal satellite images are very useful to detect the changes in land use and land cover comprehensively. Land use and land cover changes have wide range of consequences at all spatial and temporal scales. It is observed from the study that the LULC pattern and its spatial distribution are the major essentials for a positive land-use strategy necessary for the development of any area.

REFERENCES

[1] Ahmad, F., & Goparaju, L. (2016). Analysis of urban sprawl dynamics using geospatial technology in Ranchi City, Jharkhand, India. Journal of Environmental Geography, 9(1–2), 7–13.
[2] Chandrasekar V et.al, 2017. Impact of Urbanization on Water Bodies Using Remote Sensing Techniques - A Case Study of The Shrinking Ambattur Lake, Chennai, Tamilnadu, India, "J. Adv. Res. GeoSci. Rem. Sens" vol 1 & 2
[3] Meyer, W. B., & Turner, B. L., II. (1992). Human population growth and land use/cover change. Annual Review of Ecology and Systematics, 23, 39–61. http://www.jstor.org/ stable/2097281.
[4] Kahlon, S., 2015. Land use land cover change and human–Environment interaction: the case of Lahaul valley. International Journal of Geomatics and Geosciences, volume 6, No 2.
[5] Kenneth Mubea 2012, "Monitoring Land-Use Change in Nakuru (Kenya) Using Multi-Sensor Satellite Data", Advances in Remote Sensing, pp 74 - 84
[6] Moghadam, H. S., & Helbich, M. (2013). Spatiotemporal urbanization process in mega city of Mumbai, India: A Markov chains-cellular automata urban growth model. Applied Geography, 40, 140–149.
[7] Mercy C Cheruto, 2016., "Assessment of Land Use and Land Cover Change Using GIS and Remote Sensing Techniques: A Case Study of Makueni County, Kenya", Journal of Remote Sensing & GIS,
[8] Rai, P.K., Sweta and Mishra, A., Onagh, M., 2011. Multi Seasonal IRS-IC LISS III data for Change Detection Analysis and Accuracy Assessment: A Case Study, International Journal of GIS Trend. Academy Science Journals, 2 (1), 13-19.
[9] National LULC Mapping using Multi Temporal Awifs Data, Bhuvan, NRSA Project report 2004 – 05
[10] Vitousek, P. M., Mooney, H. A., Lubchenco, J., & Melillo, J.M. (1997). Human domination of Earth's ecosystems. Science, 277, 494–499.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY