iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** X **Month of publication:** October 2017

DOI: http://doi.org/10.22214/ijraset.2017.10125

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue X, October 2017- Available at www.ijraset.com

Urban Landscape Analysis Using Remote Sensing and GIS in Kollam District

Parvathi Suresh L[1], Dr.Smitha Asok V[2], [1]Rajani Kumari, [1]Reshma R.S
[1]*PG studentPost Graduate Department of Environmental Sciences, All Saints' College, Trivandrum*
[2]*Assistant Professor Post Graduate Department of Environmental Sciences, All Saints' College, Trivandrum*

Abstract: Urbanization is one of the most important factor for land use and land cover change. Urban landscape analysis mainly used for monitoring and socioeconomic and ecological consequences of urbanization The urban expansion process hence needs to be monitored, quantified and understood for effective planning and the sustainable management of natural resources. Remote sensing technology mainly used in acquisition with accurate and detailed land use information for proper planning and management of urban regions. This study aims to determine the qualitative and quantitative analysis of urban growth of Kollam region using Remote Sensing Geographic Information System and Urban Landscape Analysis Tool. Urban footprints, (UF),Urbanized area (UA) and New Development (ND) maps are generated from Urban Landscape Analysis Tool in order to quantify the rate of urbanization based on the spatial density of built up area. For this, the land use/land cover data of different time periods were used, which was derived from satellite images of various time periods (1988, 2000, 2010 and 2017) which were used in conjunction with other geospatial datasets, to quantify different categories of land degradation.
Keywords: Urbanization,Urban landscape, Urban footprint, Urbanized area, New development, Supervised classification, Remote sensing

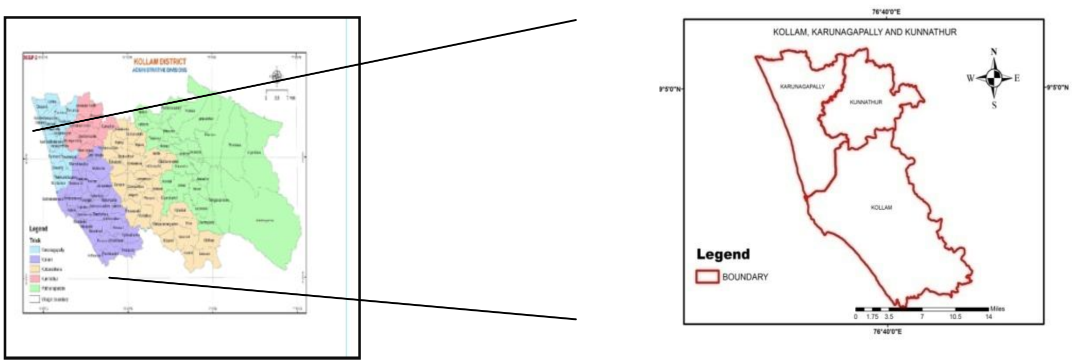
I. INTRODUCTION

Urbanization indicates to the process by which rural areas become urbanized due to economic development and industrialization. Urbanization is a shift of population from rural areas to urban areas and slight increase in the proportion of people living in urban areas(Aswathy et al.,).Urban growth is a global phenomena and one of the important reforming processes affecting both natural and human environment through many ecological and socio-economic processes (Mandela's et al., 2007). Urbanization is one factor that leads to landscape degradation. It involves transformation of various land uses into urban areas wherein unplanned urban expansion leads to environmental degradation causing shortages of housing, worsening water quality, excessive air pollution (Ramachandra et al., 2012, Uttara et al., 2012).Urban landscape analysis provides the spatial properties and configuration of the area at a particular time (Galster et al., 2001). The urban patterns mainly deal with the physical structure and the spatial characteristics of the urban processes that vary over time (Aguilera et al., 2011). Urban patterns have been analysed using various spatial metrics (Jiang et al., 2007, Angel et al., 2007, Bharath et al., 2012, Ramachandra et al., 2012). Landscape degradation reduces the ability of the land to perform many biophysical and chemical functions. Over exploitation of environmental resources by humans and by grazing animals, non scientific political decisions or economic policies add external impetus to landscape degradation.Long term detecting of changes in land degradation is accomplished by spatially comparing different multi temporal satellite images. It involves looking for difference between two surface models that are obtained at different times Areas affected by degradation can be identified and mapped from Land sat Thematic Mapper(TM) images. This paper describes urban landscape analysis using Remote sensing and GIS in Kollam district.

II. STUDY AREA

The present study was carried out in three taluks of Kollam which includes Kollam, Karunagapally and Kunnathur located in southwest part of the Kerala. The taluk Kollam lies between North latitudes 8^0 45'and $9^0$07' and East longitudes 76^0 29'and 77^0 17'. Karunagapallytaluk lies between North latitudes 9^0 32'83'' and East longitudes 76^0 32'12''.Kunnathurtaluk lies between North latitudes 9^0 18' 20''and East longitudes $77^0$25'06''.The major roadways connecting these taluks are NH 66, NH 183 and NH 744 and state highway MC road and PunalarPathanamthittaMuvattupuzhza main eastern highway. The climate is tropical humid with average temperature around 25^0 to 32^0 and average annual rainfall of 2555mm

Figure1 location map of the study area



III. MATERIALS AND METHODOLOGY

A. Materials

The study objective of assessment of landscape degradation and urban dynamics was accomplished using multispectral spatial data Land sat series data having path-144,and row-054 of years 1988, 2000, 2010 and 2017 were used for this purpose.(Table 1).The major softwares used for the study includes ArcGIS 10.4, ENVI 5.3+ IDL 8.3(64 bit) and ULAT

SL NO	Data Used	Path/Row	Date of pass	Spatial resolution	Purpose
1	LANDSAT 5 Thematic Mapper Image	144/054	09-01-1988	30m	Urban landscape analysis
2	LANDSAT ENHANCED Thematic Mapper+(ETM+SLC on)	144/054	03-01-2000	30m	Urban landscape analysis
3	LANDSAT ENHANCED Thematic Mapper(ETM+SLC off)	144/054	09-01-2010	30m	Urban landscape analysis
4	LANDSAT Operational Land Image(OLI)	144/054	08-01-2017	30m	Urban landscape analysis

B. Methodology

1) Digital Data Processing: The Land sat TM image has been geometrically referenced to the Universal Transverse Mercator (UTM) projection zone 43, with a spatial resolution of 30 m. The remote sensing data obtained were geo-referenced, geo-corrected, rectified and cropped pertaining to the study area. Satellite imagery was stacked into different bands to produce a false color composite. After geo correction images were digitized in GIS environment using ArcGIS software 10.4 in the form of polygons represent various categories. Digitization of boundary is followed by boundary clipping which is done in Arcmap. LANDSAT data

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue X, October 2017- Available at www.ijraset.com

which have undergone radiometric calibration, atmospheric correction and flaash process been clipped with boundary which is digitized and undergone for supervised classification.

2) Classification Analysis: The images of the year 1988, 2000, 2010 and 2017 were subjected to supervised classification. Images were divided into 4 classes with the help of training sits representing a particular land cover type. The area of each of the four classes was calculated using field calculator in ArcGIS.

3) Urban Landscape Analysis using ULAT: The images undergone supervised classifications were reclassified into three classes urban, water and other data. Processed images were inserted into ULAT. For each input of land cover map the two output maps will be generated. They are urban footprint map and urban area map and for each consecutive land cover maps a new development classification map is also generated.

IV. RESULTS AND DISCUSSIONS

The results of urban landscape analysis is determined using urban landscape analysis tool. Urban area classification, Urban footprint classification and New development classification are obtained.

A. Evaluation of Urban Footprint Classification

Urban footprint indicates the evaluation for impact of development on open land around the city. This map consists of seven categories in the study area based on different urbaneness values and their land cover attributes. There is decrease of urban and suburban built up during time span of 1988-2017.Urbanization of rural settlements has resulted into increase of 2.42 sq.km. This slight increase is due to urbanization of rural areas and extension of urban services towards the rural areas. There is an expansion and development during the study period and an increase of 12.072sq.km was noticed fringe open lands. Another important change in the urban footprint classification was the decrease in captured open land and rural open land. The area of the different urban foot print features were calculated and represented in Table 2. The map showing urban footprints of four year 1988, 2000, 2010 and 2017 are given below.(Figure 2 and 3)

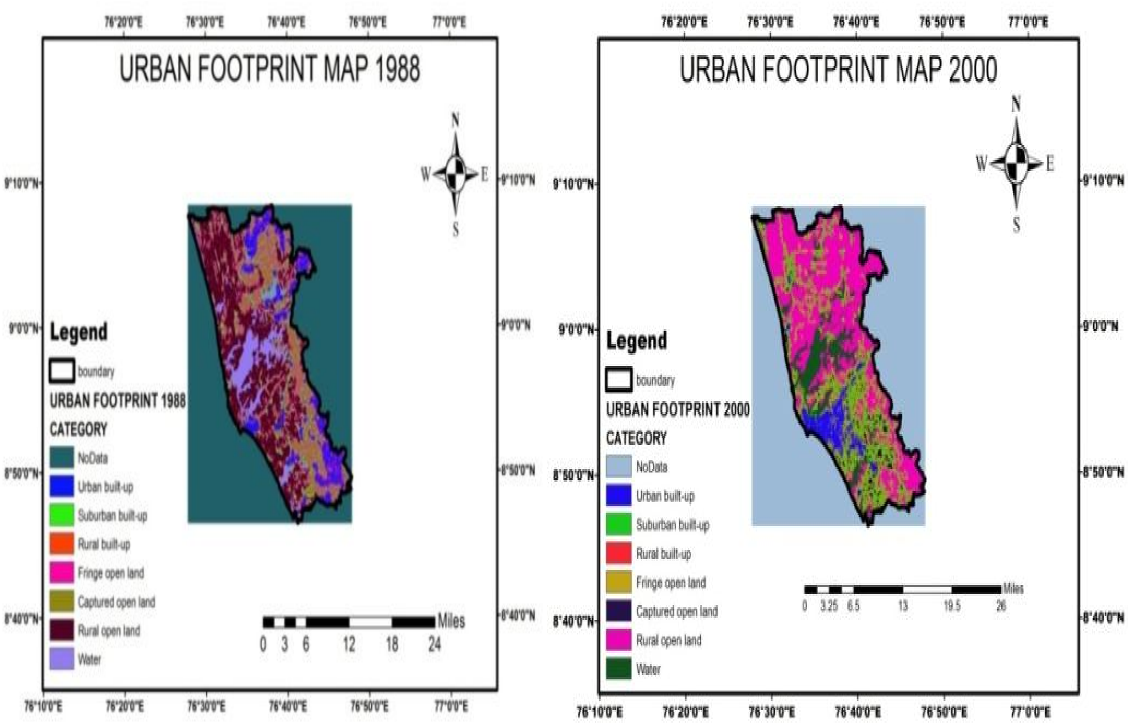


Figure 2.urban footprint maps of the study area in 1988 and 2000

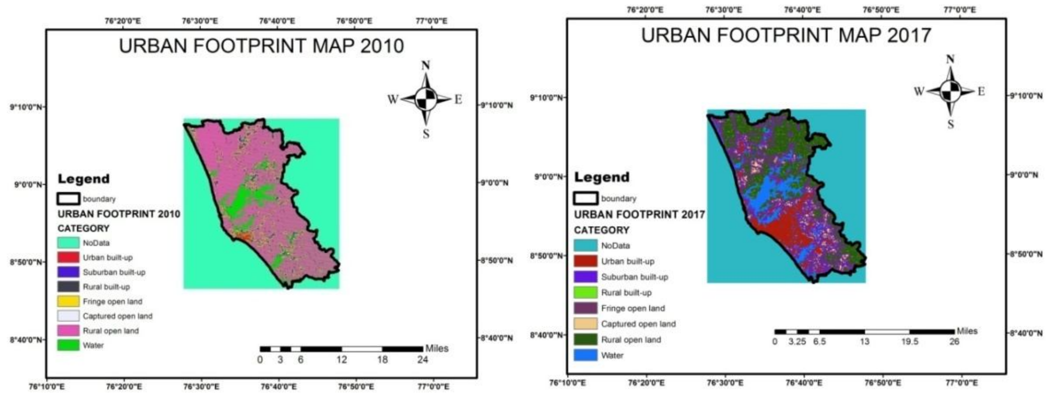


Figure 3.urban footprint maps of the study area in 2010 and 2017

Urban Footprint Classification

URBAN FOOTPRINT/YEARS	1988(Sq.Km)	2000(Sq.Km)	2010(Sq.Km)	2017(Sq.Km)
No Data	0	0	0	0
Urban Built Up	71.661	45.500	4.932	70.744
Sub urban Built Up	102.073	77.76	31.734	95.610
Rural Built Up	6.562	10.602	11.16	8.9901
Fringe Open Land	175.784	141.633	40.5216	187.856
Captured Open Land	32.244	21.2706	0.2565	25.0281
Rural Open Land	241.9578	325.397	443.601	230.073
Water	0	0	0	0

Table2 Areal extent of urban foot print classes in the study area in sq. km

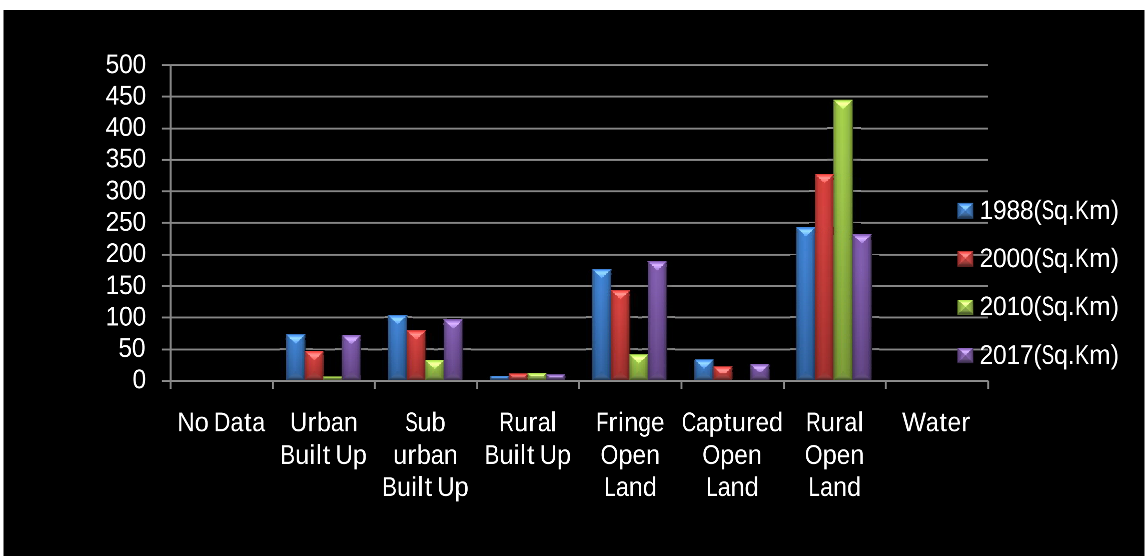


Figure 4 Areal extent of urban foot print classes in the study area in sq. km

B. Evaluation of Urbanized Area Classification

The study further analyzed the urbanized area classes to assess the impact of different levels of urbanization. Total numbers of seven classes were mapped for urbanized area. Analysis of the study areas from 1988 to 2017 showed drastic changes in urbanized area. There is a slight decrease in the area of urban and suburban built ups and an increase of rural built ups. There is a huge decline of urbanized open land and decrease of 13.364 sq.km. Urbanized open land is class that is having maximum probability of high degradation of undeveloped land patches, present in between developed lands. The area of the different urbanized area features were calculated and represented in the Table 3.

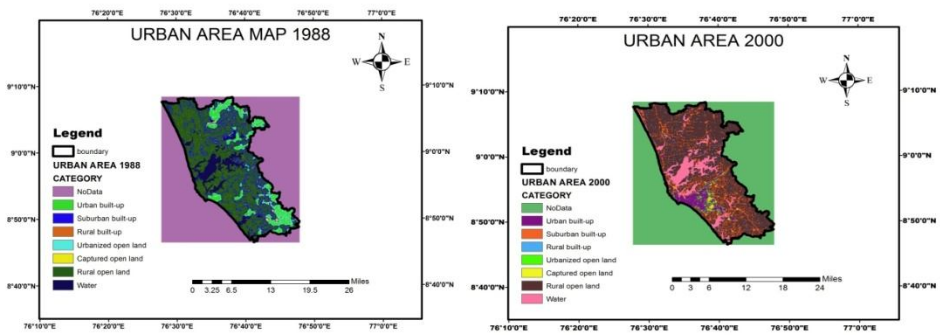


Figure 5 urban area maps of the study area in 1988 and 2000

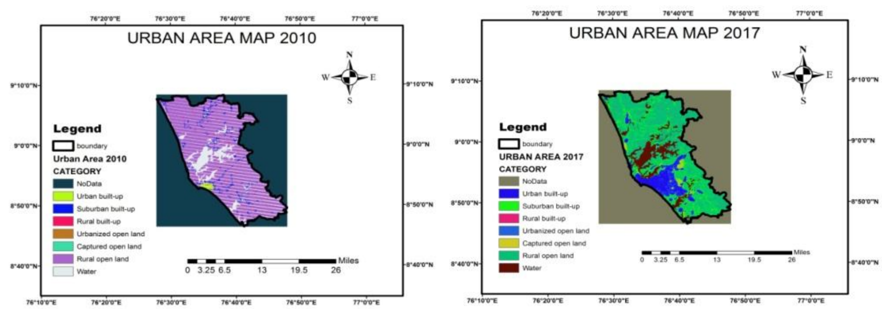


Figure 6 urban area maps of the study area in 2010 and 2017

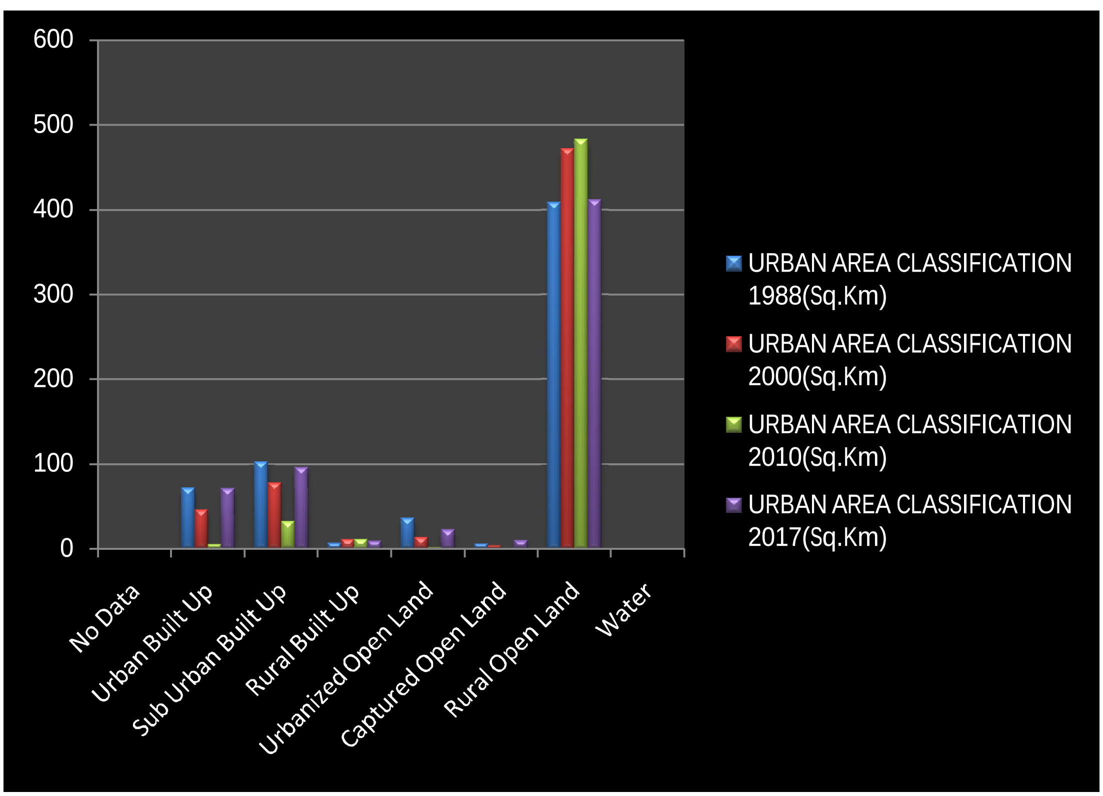


Figure 7 Areal extent of urban area classes in the study area in sq km

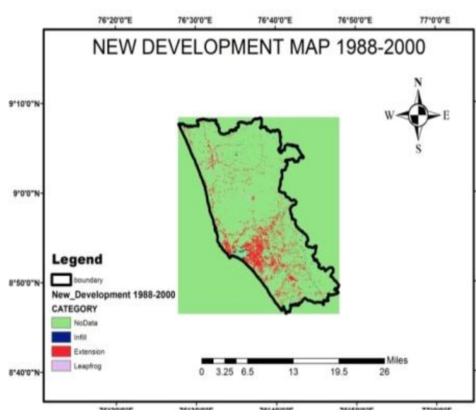
Urban Area Classification

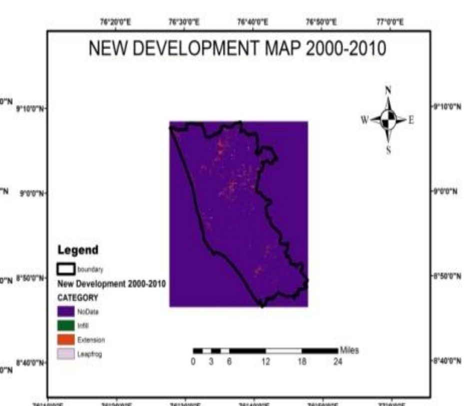
URBAN AREA/YEARS	1988(Sq.Km)	2000(Sq.Km)	2010(Sq.Km)	2017(Sq.Km)
No Data	0	0	0	0
Urban Built Up	71.661	45.5004	4.932	70.774
Sub Urban Built Up	102.073	77.76	31.734	95.610
Rural Built Up	6.562	10.602	11.16	8.9901
Urbanized Open Land	35.715	13.401	1.147	22.351
Captured Open Land	5.847	3.286	0.2232	9.7803
Rural Open Land	408.423	471.613	483.008	410.822
Water	0	0	0	0

Table 3 Areal extent of urban area classes in the study area in sq km

C. Evaluation of New Development of Kollam region

The new development (ND) of Kollam region represents the newly developed area during study period. The analysis of new development statistics revealed the pattern and type of urban growth that has been taken place in the city. Greater part of the new development is attributed to extension which accounts for more than 36.68% of developments. Leapfrog contributed 25.86% to new development and rest 3.14% developed through infill.Qualitative analysis of new development maps indicate that the development in western and eastern parts of the region has been dominated by extension process which could be attributed to coming up of new establishments of region and there areas. Sakthikulangara, Thrikkaruva, Panayan, Manyad, Kilikolloor, Vadakkevila, Thazhuthala are the regions in the west of Kollam taluk. Mulavana, Perinad are the regions in the east of Kollam taluk. Karunagappally, Athinad, Panamana and Chavara are the regions in north and few regions of Sooranad South, Sasthamcotta are the newly developed regions. Leapfrog and Extension development is prominent in the Suburban taluks of Kollam, Karunagappally, Kunnathur. Similar kind of studies were conducted over Srinagar City in evaluating urban landscape dynamics of of the city and its environs (Amin,A and Fazal,S., 2015)The area of different new development features were calculated and represented in table 5.3.The map showing newly developed regions of the four year 1988, 2000, 2010 and 2017 are given below(Figure no 8)





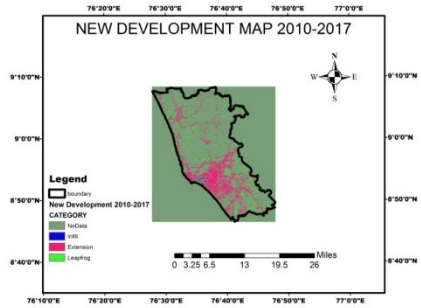


Figure 8: new development maps of the study area in 1988,2000,2010,2017

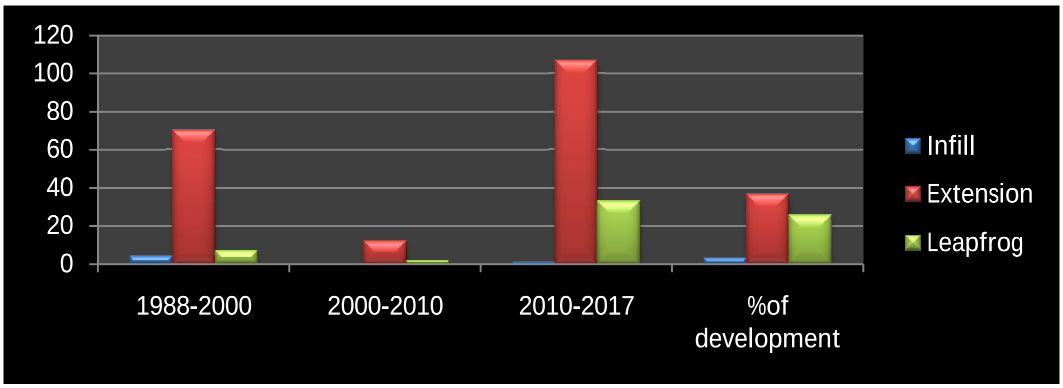


Figure 9 Areal extents of urban area classes in the study area in sq km

New Development Classification

NEW DEVELOPMENT CLASSES/YEARS	1988-2000	2000-2010	2010-2017	%of development
Infill	4.3686	0.2826	1.2222	3.14
Extension	70.3602	12.4398	107.046	36.68
Leapfrog	7.2117	1.8945	33.0759	25.86

Table 4 Areal extent of urban area classes in the study area in sq km

V. CONCLUSION

On the basis of the results obtained in our study the urban landscape analysis demonstrates that expansion of built up in the region mainly due to extension development 36.68% of total development. Urban area and urban footprint map statistics reveal that urban and sub urban built up slight decrease during 1988-2017 time period with an increase of rural open land. The study clearly shows the trend and pattern of urban expansion in Kollam region on open lands.

REFERENCES

[1] Aguilera F., Valenzuela L., Leitao A. (2011), “Landscape metrics in the analysis of urban land use patterns”: A case study in a Spanish metropolitan area, Landscape and Urban Planning A Journal of the Human Environment, and Urban Analysis., Vol 4, pp 3-18
[2] Angel S, Parent J, Civco D (2007) “Urban sprawl metrics: an analysis of global urban expansion using GIS” Proceedings of ASPRS 2007 annual conference, Tampa, pp 7–1.
[3] Amin A and Fazal.S ., 2015 “Evaluating Urban Landsacpe Dynamics over Srinagar City and Its Environs,India” , Journal of Geographic Information System, Volume 7, pp 211-225.
[4] AswathyAsok, SmithaAsok V, Rajesh Reghunath, “Assesment of changes in landscape pattern due to urbanization pressure in Thiruvananthapuram city from Kinfra to Vizhinjam” Emer Life Sci Res (2016) 2(2): 30-33

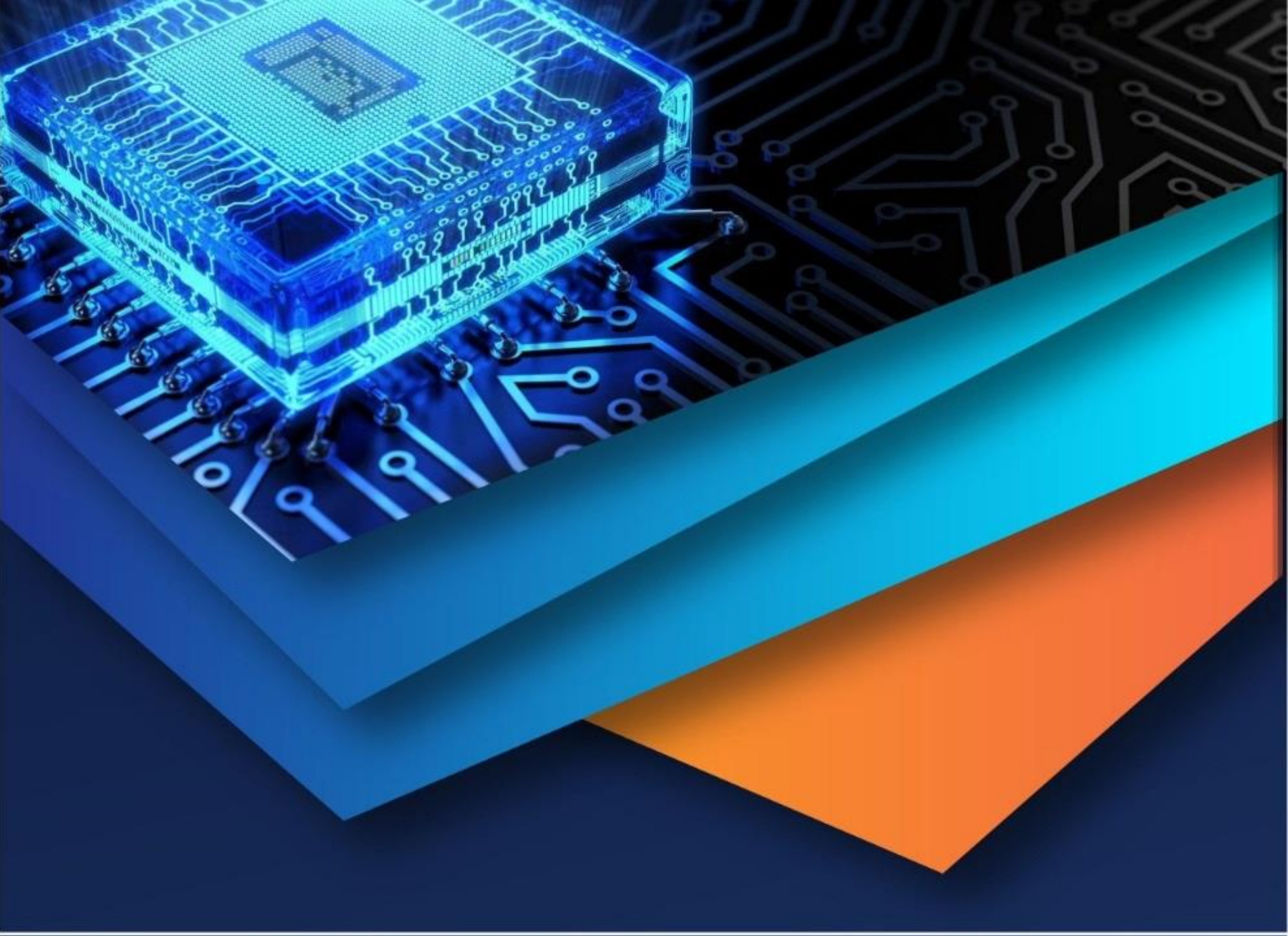
[5] Galster G., Hanson R., Ratclfee M. R. 2001, "Wrestling sprawl to the ground: Defining and measuring an elusive concept, Housing Policy Debate "International Journal of remote sensing" Volume 12, pp 681-717.

[6] Jiang F., Liu S., Yuan H., Zhang Q. (2007), "Measuring urban sprawl in Beijing with geo-spatial indices", Journal of Geographical Sciences Volume 17, pp 469-478.

[7] Mandela's., 2007" A Fuzzy Cellular Automata Based Shell for Modelling Urban Growth A Pilot Application in Mesogia Area", Journal of Indian Society of Remote Sensing, Volume 73, pp 139-15

[8] Ramachandra T. V., Bharath A. H., Durgappa D. S. (2012), "Insights to urban dynamics through landscape spatial pattern analysis", Int. J Applied Earth Observation and Geoinformation Volume 18, pp 329-343

[9] Uttara S., Bhuvandas N., Aggarwal V. (2012), "Impacts of Urbanization on environment", International Journal of Research in Engineering and Applied Sciences Volume 2, 16371645.



10.22214/IJRASET

INDEX COPERNICUS
45.98

IMPACT FACTOR:
7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR:
7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY