



URBAN SPRAWL USING GIS IN AND AROUND KUMBakonAM MUNICIPALITY, TAMILNADU, INDIA

Geography

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ABSTRACT

Urbanization is rapidly increasing nowadays and can be interpreted that there is an increasing economic specialization and advancing technology which results in the accumulation of people. Kumbakonam (Temple City) and its adjacent rural areas, located in South India has experienced the same in the past two decades. Urban population growth occurs in the study area with major processes led to a slow by slow transformation of agricultural land and the others into urban land-uses leading to increase in more built-up area. This study attempts to measure and analyze urban sprawl in the study area using temporal data changes for years 1980 and 2018 using ARC GIS.

KEYWORDS

Urban Sprawl, Built-up area Mapping, Buffer Analysis and GIS.

1.0 INTRODUCTION

Nowadays Urban sprawl is considered as a frequent phenomenon that takes place in every city. Two major causes are responsible for the growth of urbanization and its rapid spread from the beginning of the 21st century. The first is development of technology and rapid industrialization, and the second is unplanned migration to large cities from the rural areas. Urbanization is two-way processes because it involves not only movement from village to cities and change from agricultural activities to commercial and service activities but it also involves change in the attitudes and behavior patterns of migrant peoples. The global population has grown dramatically during the last century. Meanwhile, we have witnessed an unprecedented concentration of population into urban places around the world. Spatial analysis will be hence helpful in finding the optimum benefits of better accessibility. Demographic Profile of Surrounding Villages of Kumbakonam Town is necessary in this research in order to find out the urban growth not only inside the municipality limit and beyond the limit too. Spatial analysis here includes various methods viz buffer analysis, spatial statistical analysis and built-up area analysis. In order to achieve sustainable growth urban planning is essential, in this connection urban sprawl monitoring is necessary.

1.1 Literature Review

Belal and Moghanm (2011) found the urban sprawl in two major districts in the Egypt. Land sat images like Multispectral Scanner (MSS) in the 1972 and Enhanced Thematic Mapped (ETM) in the 2005 were used to assess the changes of urban encroachment, agricultural lands and water areas during this period with integration by GIS. Aguilar (2008), states that, urbanization is one of the most striking human induced land transformations of the current era. Cities are expanding in size and relative importance in many parts of the world due to rapid expansion of urban population. Suzanchi et al (2006) stated that most land use changes occur without a clear and logical planning with little attention to their environmental impacts. It was reported that in the last four decades, urban growth in Delhi has occurred rapidly without scientific planning that destroyed valuable agriculture lands in its surround. **Lambin et al (2003)** carried out a study on dynamics of land use and land cover changes in tropical regions. They highlighted the complexity of land use / land cover change and proposed a framework for a more general understanding of the issue, with emphasis on tropical regions. **Rajan and Shibasaki (2001)** conducted a study on a GIS based integrated land use/ Land cover changes model to understand agricultural and urban land use changes. They have developed a national scale, integrated, dynamic time-series simulation model called the "Anthropogenically Engineered Transformations of Land Use and Land Cover" (AGENT-LUC) model, which simulates two major land classifications namely, agricultural and urban. **Ridd and Liu, (1998)**, reported that the Remote Sensing in land use / land cover change studies become widely recognized as an effective method of change analysis and discussed on land owner behavior, which is a major determinant of land use and land cover changes.

2.0 Study Area

Kumbakonam is a special grade Municipal Town and second biggest

town in terms of administrative status to Thanjavur District and has been shown in Fig 2.1. It is situated 10°57' North Latitudes and 79°23' East Longitude Kumbakonam is located 313 km away from Chennai on the South, 90 km away from Trichy on the East and 40 Km away from Thanjavur on the North-East. The town is bound by River "Cauvery" on the North and "Arasalar" on the South with a gentle slope from north to south. Civil Administration was looked by a town level committee (Municipal Committee) which was formed in 1866 with an extent of 7.68 Sq.km. At present, the Kumbakoardnam town extends over an area of 12.58 Sq.km and the local planning area extends over an area of 64.02 Sq.Km. According to 2011 census, Kumbakonam had a population of 140,156 people.

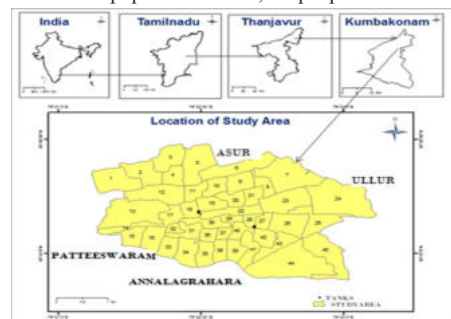


Fig.1 Study Area

3.0 Aims & Objectives

To carry out the quantitative analysis of the Urban development in and around study area.

- Mapping of built-up area for the year 1980 and 2018 and to find out the Urban areas by using buffer analysis for the adjacent proposed villages.
- Mapping of built-up area for the year 1980 and 2018 and to find out the Urban sprawl by using overlay analysis for the adjacent proposed villages.
- To identify the overall Spatial, temporal Changes in built up areas and to find the directional growth for the Study area.
- To find out the more accessibility area in and around study area.

4.0 Methodology And Materials

The methodology includes, the built-up area was mapped from the topographical sheet for the year 1980 and converted in to digital format. Next, for 2018, the built-up area was mapped from IRS P6 satellite data using Arc GIS. Then quantification of vector data derived from satellite data is done. Finally, the changes were measured using results.

5.0 Remote Sensing and GIS in Urban Sprawl

GIS and remote sensing are very useful with respect to formulation and implementation of the spatial and temporal changes, which are vital components of regional level planning. Kumbakonam Municipality has proposed the following villages to be included within the Municipal limits. The list of proposed villages is as follows:

Annalagraharam, Darasuram, Perumandi, Palavathankattalai, Thepperumanallur, Ullur, Karuppur, Muppakoil, Umamahesharapuram, and Koranattukaruppur. Here the proposed villages were buffered to 1 km circular area and the built-up areas were extracted to produce the buffer built-up area analysis.

5.1 Built Up Area Analysis (Proposed Villages In 2018)

The built-up areas were extracted from the 2018 data for the proposed ten villages and are shown in Fig 2 and simultaneously the data were calculated and shown in Table-1. Darasuram, Muppakoil and Ullur villages have more than 50% of built-up areas.

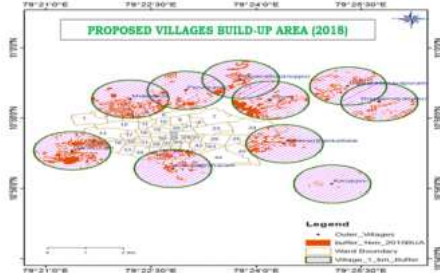


Fig 2 Proposed Villages Built-Up Areas (2018)

5.2 Built Up Area Analysis (Proposed Villages In 1980)

The built-up areas were extracted from the 1980 data for the proposed ten villages and are shown in Fig 3 Darasuram, Muppakoil and Annalagraharam villages have more than 15% of built-up areas.

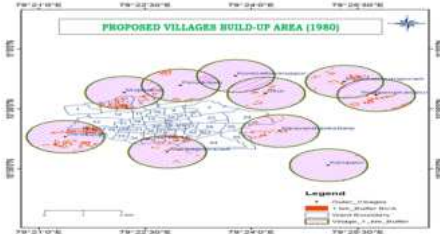


Fig 3 Proposed Villages Built-Up Areas (1980)

Table 1 Buffer Built-up Area Analysis For Proposed Villages

Villages	2018 BUA (sq.k m)	Area (sq.k m)	1980 BUA (sq.k m)	BUA % in 2018	BUA % in 1980	Changes (1980-2018)	Change %
Annalagraharam	0.39	1	0.16	38.5	16.0	0.23	22.5
Darasuram	0.82	1	0.31	81.6	31.1	0.50	50.5
Karuppur	0.03	1	0.01	3.2	0.6	0.03	2.6
Koranattukaruppur	0.32	1	0.00	32.4	0.0	0.32	32.4
Muppakoil	0.62	1	0.18	61.5	18.0	0.44	43.5
Palavathankattalai	0.37	1	0.11	37.2	10.6	0.27	26.6
Perumandi	0.36	1	0.08	36.1	7.8	0.28	28.3
Thepperumanallur	0.24	1	0.15	23.6	14.5	0.09	9.0
Ullur	0.59	1	0.06	58.5	6.1	0.52	52.5
Umamahesharapuram	0.33	1	0.11	33.3	11.3	0.22	21.9
Total	4.06	10	1.16	40.6	11.6	2.90	29

5.3 Built Up Area Change Detection Analysis

The highest Built up Area changes are observed in Darasuram and Ullur villages having more than 50%. The lowest Built up Area changes are observed in Karuppur and Thepperumanalur villages having less than 10%. Thus, the built-up areas are increased roughly from 1sq km to 4 sq. km area from the year 1980 to 2018. From the buffer analysis, except the three villages viz, Umamahesharapuram, Thepperumanallur and Karuppur all the seven remaining villages have more accessibility to the study area so that more likely development will take place in near future. From the multiple ring buffer analysis, except four villages viz, Umamahesharapuram, Thepperumanallur, Darasuram and Karuppur all the six remaining villages have come under more accessibility to the study area within 3 km indicating highly accessible area.

6.0 Overall Analysis

Figure 4 indicates the likely proposed villages to be added to the municipality limit. Thus, this type of study gives future insight to the

urban planners to make it of optimum utilization. The built-up areas were extracted from the 1980 & 2018 data for the proposed ten villages along the study area and are shown in Figure 5 & Figure 6 and the same is overlaid one another to explicit the directional growth of urban area particularly in the North East direction that are shown in Figure 7 succeeding further.



Fig 4 Proposed Villages Around Study Area



Fig 5 Proposed Villages Built-up Areas (1980)

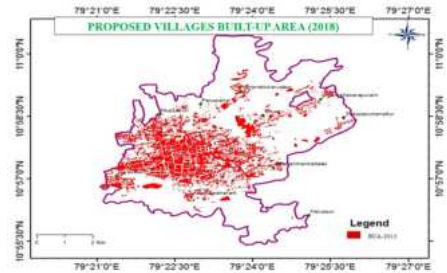


Fig 6 Proposed Villages Built-up Areas (2018)

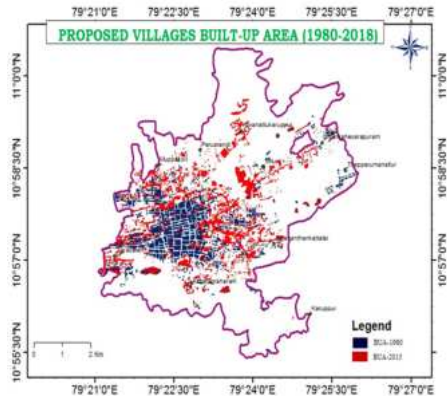


Fig 7 Proposed Villages Built-up Areas (1980-2018)

7.0 RESULTS & DISCUSSION

The changes in urban sprawl is carried out with satellite data give validating results. From the buffer analysis, except the three villages viz, Umamahesharapuram, Thepperumanallur and Karuppur all the seven remaining villages have more accessibility to the study area so that more likely development will take place in near future. It is concluded that Darasuram, Muppakoil and Ullur villages are expected to more urbanization other than remaining proposed villages. This study conceptualized urban sprawl from a geographic perspective in order to assess the spatial distribution. Also, the built-up area for the years 1980 and 2018 mapped using ARC GIS and the changes were measured which depicts urban growth elevating near future. The study explicit the directional growth of urban area particularly in the North East direction.

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