Urban Population Growth Using GIS in Kumbakonam Municipality, Tamilnadu,India

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Abstract

Urbanization is the processes by which villages turn into towns and towns develop into cities. It is a process and can be interpreted that there is an increasing economic specialization and advancing technology which results in the accumulation of people. Kumbakonam Municipality, located in South India has experienced rapid urbanization 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 into urban land-uses leading to increase in more built-up area. This study attempt to measure and analyze urban growth in the study area using temporal data changes for years 2000 and 2015 using ARC GIS.

Keywords: Urban Population Growth,Built-up area Mapping, Buffer Analysis and GIS

1.0 Introduction

Urbanization is the processes by which villages turn into towns and towns develop into cities. Two major causes are responsible for the growth of urbanization and its rapid spread from the beginning of the 21th 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. Man has always tried to improve his lifestyle everybody, because the new invention of instruments helps to reduce the working time which in turn brought changes in human lifestyle change.Change detection analysis is an important key to understanding changes took place over time.Towns and cities have acted as focal points in the cultural landscape of world. Areal differentiation of any phenomenon became not only complex but also dynamic posing challenges to geographical research.

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 Mapper (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 transformation 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 Shibasak (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 $10^{\circ}57'$ North Latitudes and $79^{\circ}23'$ 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 Kumbakonam 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.Kumbakonam was the second capital of Cholas who ruled since third century

and developed as a religious center with more than 180 temples which attract large number of people from various places resulting in significant high population.
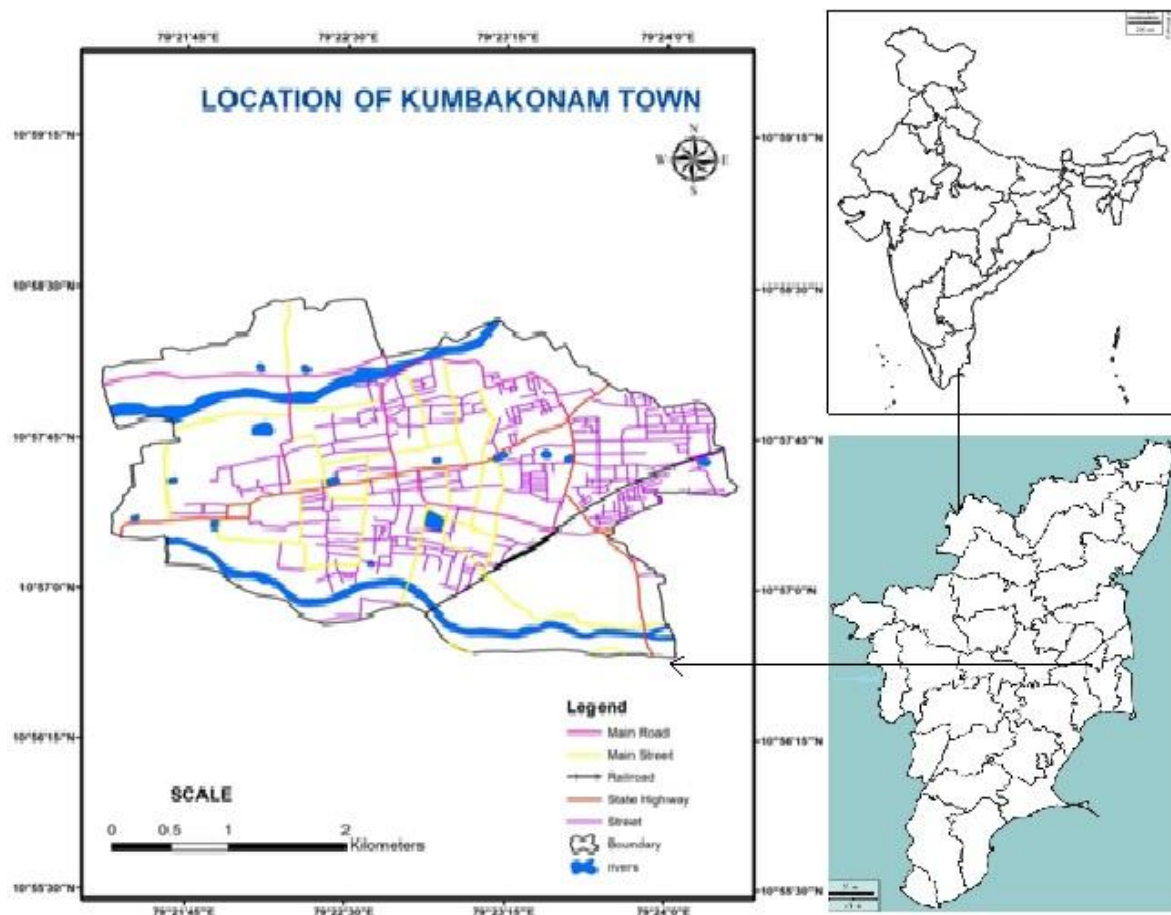

Figure.1 Study Area

3.0 Methodology and Materials

The methodology includes, quantification of statistical data to find out the population and household density in each ward and the year 2000built-up area were mapped from the LANDSAT 5TM and converted in to digital format. Next, for 2015, the built-up areawas mapped from IRS P6 satellite data using ArcGIS. Finally, the changes were measured using results.Buffer analysis done to find outease of transport facility to the study area.

4.0 Population & Household Density

In order to find out the population and household density in each ward the population and household data were divided by the area of each ward for the years 2001 and 2011 and the results arrived at each ward level were quantified by using GIS and has been shown in the Table 1 Population and household density are concentrated in the core area of the study area rather than

outer area that can be clearly seen in the Figure 2 & 3. It actually depicts that the influence of natural landscapes made the criteria concentrated over the central parts

Table-1 Household and Population Density

Ward no	Area in Sq.Km	2001 Population Density	2001 Household Density	2011 Population Density	2011 Household Density
1	0.46	8070	1783	8430	2046
2	0.32	7613	2013	10278	2438
3	0.29	10590	1624	14431	3093
4	0.2	9830	3690	11665	2805
5	0.4	7370	1488	8203	2083
6	0.45	11120	2267	8947	2307
7	0.63	7533	1710	8537	2189
8	0.15	24340	5547	26053	6973
9	0.25	14272	2808	11876	3472
10	0.18	21106	4867	19206	5161
11	0.16	16656	4138	18356	4738
12	0.45	8491	1953	8684	2280
13	0.7	4274	1113	5056	1307
14	0.14	13793	3164	14329	3786
15	0.21	17562	3595	14443	3690
16	0.24	10813	2608	15204	3792
17	0.18	16872	4444	23722	6283
18	0.14	22386	4229	19036	4693
19	0.19	15542	4016	16853	4253
20	0.17	14571	2859	14212	3876
21	0.15	28380	4033	19220	5133
22	0.25	8140	2080	9516	2460
23	0.48	9035	1504	6302	1431
24	0.97	4261	779	4333	1094
25	0.33	8509	2542	10291	2467
26	0.36	8472	1681	7017	1589
27	0.11	37900	5582	22618	5145
28	0.09	12067	3400	18300	4789
29	0.09	14378	2800	13900	3400
30	0.19	16837	3084	13105	3116
31	0.18	19411	4078	19906	5067
32	0.07	33271	8671	36486	9314
33	0.16	27263	5800	19444	5063
34	0.25	17932	3972	14720	3728
35	0.18	14817	4189	17772	4539
36	0.11	33773	5973	23727	6282
37	0.08	32300	7325	30138	7463
38	0.13	17246	3777	20546	5446
39	0.18	17811	3872	19567	4778
40	0.13	9508	1777	11092	3008
41	0.22	13336	3091	12745	3414
42	0.18	12444	2994	14711	3656
43	0.22	18200	3859	14991	4132
44	0.97	3155	924	4669	1128
45	0.58	4890	1228	5995	1503
Total	12.58	11125	2442	11141	2823

The population density of the study area was 11125 for the year 2001and 11141 for the year 2011.The household density of the study area was 2442 for the year 2001and 2823 for the year 2011.
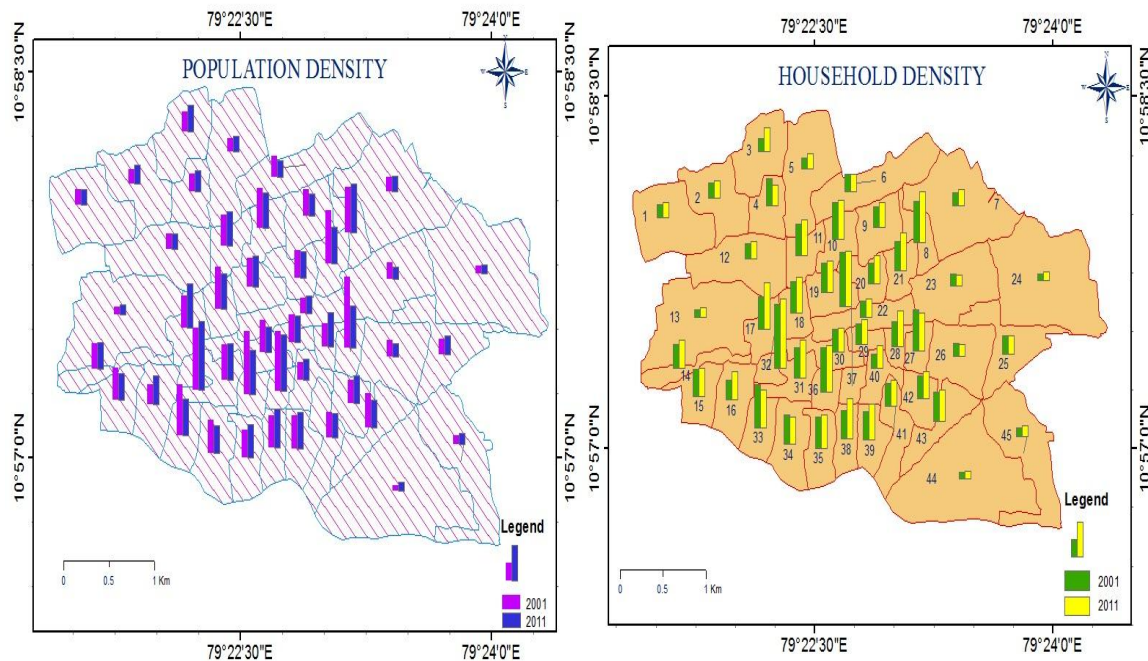

Figure.2 Population Density (2001-2011)   Figure.3 Household Density (2001-2011)

5.0 Built-up Area Mapping

The built-up areas for the year 2015 were extracted from the IRS P6 LISS IV images using Envi 4.3 software and the areas of built-up were calculated using GIS for each ward in sq.km. The resultant map obtained was shown in the Fig 4. About 5.75 sq.km areas were covered by the built-up urban areas in this year in the study area.
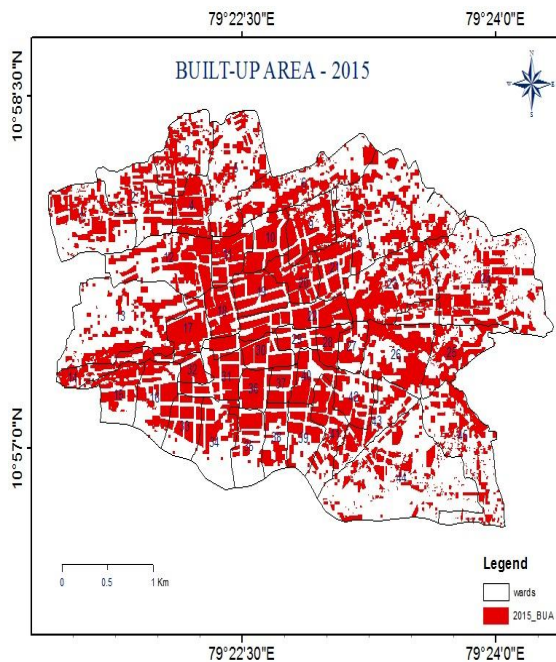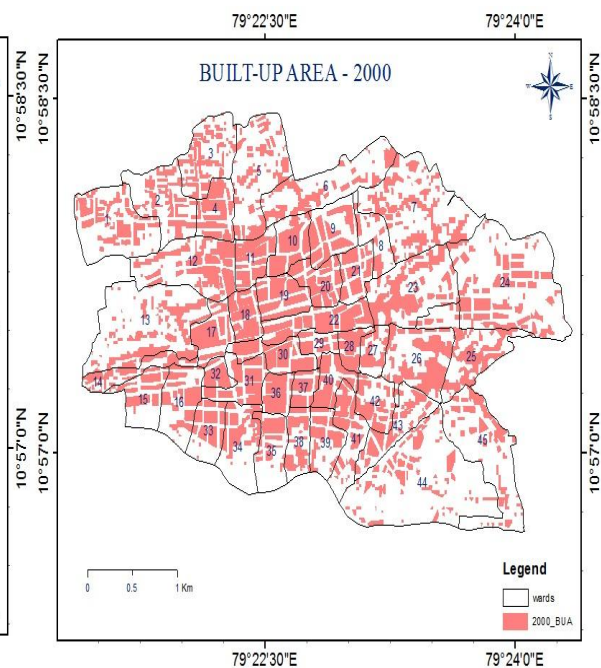
Figure.4 Built-up areas-2015

Figure.5 Built-up areas - 2000

The built-up areas for the year 2000 were extracted from the landsat TM images using Envi 4.3 software and the areas were calculated using GIS for each ward in sq.km. The resultant map obtained was shown in the Fig 5. Nearly 4 sq.km areas were covered by the built-up urban areas in this year in the study area. Thus nearly 1.75 sq.km (30%) has been increased in the years 2000 to 2015.

5.1 Buffer Mapping

In GIS buffer analysis tool is very helpful in the analysis of buffer distance between the basic amenities to the study area. Here the buffer analysis done for the two main place railway junction and bus stand of the study area. From those two place buffer were created upto 1 km to find out the nearby beneficiary wards of the study area. The resultant intersectional analysis was shown in Fig 6.
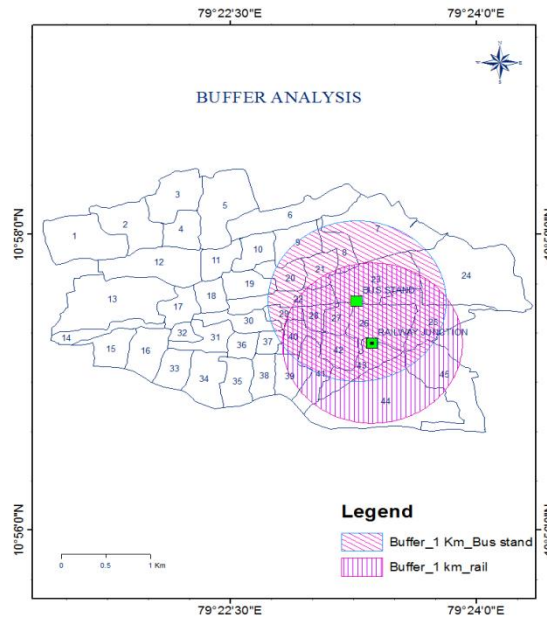
Figure.6Buffer Intersectional Analysis

Wards 22, 23, parts of 24, 25-28, parts of 29 and 39 and from 40 to 45 wards are the highest beneficiary wards in terms of nearby accessibility to the rail network. Wards 7 to 9 and 20 to 43 are the highest beneficiary wards in terms of nearby accessibility to the nodal road network. Wards 22, 23, 25 to 29 and 40 to 43 are the highest beneficiary wards in both road and rail accessibility.

6.0 Results & Discussion

Kumbakonam was the second capital of Cholas who ruled since third century and developed as a religious center with more than 180 temples which attract large number of people from various places resulting in significant high population. The change in urban growth is carried out with demographic data like population and household. GIS is used to find out the comparison of each ward wise population and household density here. This study conceptualized urban population from a geographic perspective in order to assess the spatial distribution of demographic parameters. Also, the built-up areafor the years 2000 and 2015 mapped using ARC GIS and the changes were measured which depicts urban growth elevating near future.It has been observed that due to the gradual urbanization the built-up area has increased from 2000 to 2015 to about 30 percent.Buffer analysis tool is very helpful one in the analysis of buffer distance between the basic amenities to the study area. In this study buffer analysis done for the two main place railway junction and bus stand of the study area.The highest beneficiary wards in both road and rail accessibility can

be easily find out by this method. Hence proper land management policies and planning is essential to reduce the urban sprawl effect and to put effort on sustainable development.

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