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AN ANALYSIS OF URBAN DYNAMICS AND ITS IMPACT ON LAND USE- A CASE OF CHENGALPATTU MUNICIPALITY, KANCHEEPUARAM DISTRICT OF TAMIL NADU

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ABSTRACT

Urbanization, an index of changing of the economy of any region, state or nation, has been growing by leaps and bounds by the rapid growth in the world economy. Globally, agriculture has met the demands from this rapidly growing urban population, including food that is more energy- land- water- and greenhouse gas emission-intensive. But now due to the absence of proper urban planning and management the proportion of total agricultural land is being decreasing in an alarming manner. The key issues with regard to agriculture and urbanization are whether the growing and changing demands for agricultural products from growing urban populations can be sustained while at the same time a sustainable urban planning can be given in order to protect the natural resources. The study includes urban dynamics and the loss in economy due to the loss of agricultural land in order to analyse the present scenario with the help of remote sensing and statistical data analysis.

KEYWORDS: Urbanisation, Remote Sensing, Agricultural Land, Urban Dynamics, Urban Economics, Changing Land Use Practice

INTRODUCTION

Urbanization is an index of transformation from traditional rural economies to modern industrial economy. The process of urbanization results in a dense settlement called an urban area. The conglomeration of urban areas including cities and their suburbs linked economically and socially constitutes a system called a metropolitan area or region. In most urban areas in low and middle income nations, the absence of any land-use plan or strategic planning framework to guide land-use changes means that urban areas expand haphazardly. As a result, most urban settlements are characterized by shortfalls in housing, water supply, urban encroachments in fringe area, inadequate sewerage, traffic congestion, pollution, poverty and social unrest making urban governance a difficult task. India, being a developing country is facing population explosion as a major problem. Another important problem in this regard is the absence of proper, organised suitable urban and sartorial planning which is the major cause of spreading of urban sprawl. Another major problem in this regard in most of the developing countries is conversion of agricultural land (which is the source of the income in major cases), Natural vegetation, and water bodies into Built- up (settlement, transportation link, industries, commercial area). This conversion is rapidly occurring in and around the Rural – Urban fringe areas, where the natural land cover and agricultural land is being converted to commercial, residential or sometimes industrial areas which is affecting the environmental balance of that particular area. The fringe areas being nearer to the main city region attracts the daily commuters in search of better opportunities, lifestyle and all other amenities. The inhabitants of those fringe areas are usually get provoked by the huge amount of money they earn by selling their lands to the real estate owners. Thus slowly the good, fertile agricultural land

turns into the built up land. So, the main aim of the study is to assess the urban dynamics and its impact on Land use, with a special reference to the change in the agricultural land which is having a decreasing nature due to the encroachment of Built Up area.

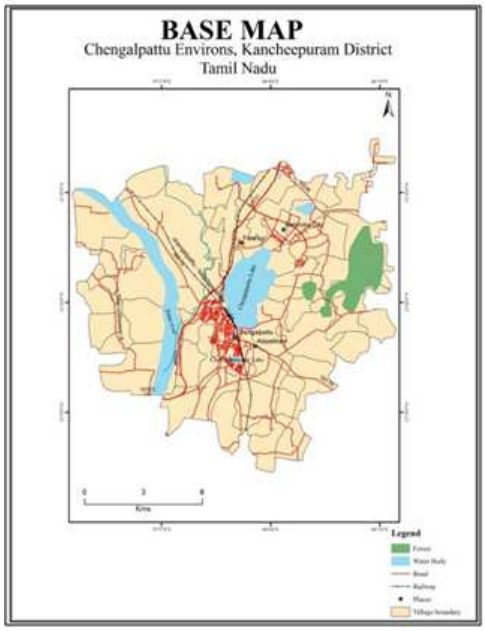

Figure 1: Base Map

DATASET DETAILS

Table 1: Details on Datasets

Sl. No	Data	Source	Resolution (Spatial)	Time
1	Toposheet	Survey of India	1:50,000	1966-67
2	LANDSAT 5 TM	http://earthexplorer.usgs.gov/	30 mt	October,1996, 2006
3	LANDSAT 8 OLI & TIR	http://earthexplorer.usgs.gov/	30 mt	October,2016
4	AsterDEM	http://earthexplorer.usgs.gov/	30mt	October,2016
5	Soil Map	NBSS and LP	30mt	December, 2016
6	Population data	http://www.censusindia.gov.in/	Village level	1991,2001,20111

METHODOLOGY

A wide number of processing steps have been included to perform the desired aim and objective of the project**.** The LANDSAT data have been normalised (haze and noise reduction) and performed LULC classification (supervised) and calculation also being carried out by using ERDAS Imagine 2014.On the other hand creation of base layer, extracting contour data, performing, DEM (Digital Elevation Model), Slope, Indices, namely Index-based Built-up Index (IBI),Normalised Difference Built-up(NDBI), Modified Normalised Difference Water Index (MNDW)I, Normalised Difference Bareness Index (NDBaI), and Normalised Difference Vegetation Index(NDVI) have been performed, using ArcGIS10.3. For the reference purpose, Google Earth has been used. Instead of generating Land use/ Land cover, directly from the corrected satellite imagery various indices have been generated first and they have been layer stacked.

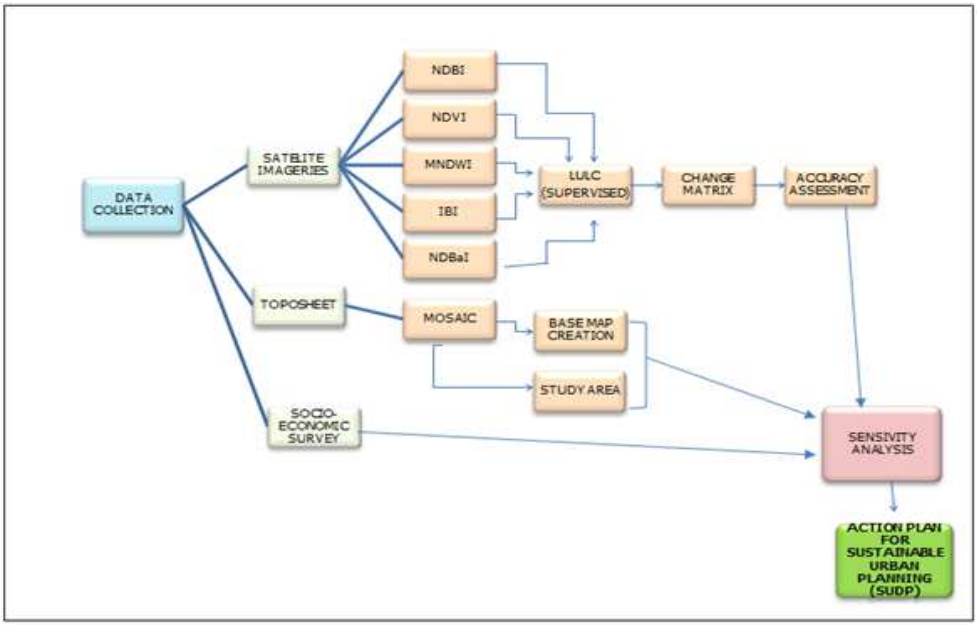

Figure 2: Flow Chart of Methodology

RESULTS AND ANALYSIS

LAND USE /LAND COVER MAP

Image Classification

Digital image processing involves the manipulation and interpretation of digital images with the aid of computers. The overall objective of image classification procedures is to automatically categorize all pixels in an image into land cover classes or themes. Supervised, unsupervised and hybrid are the three main types of image classification. LULC maps for 1996, 2006 and 2016 have been generated by supervised classification**.**

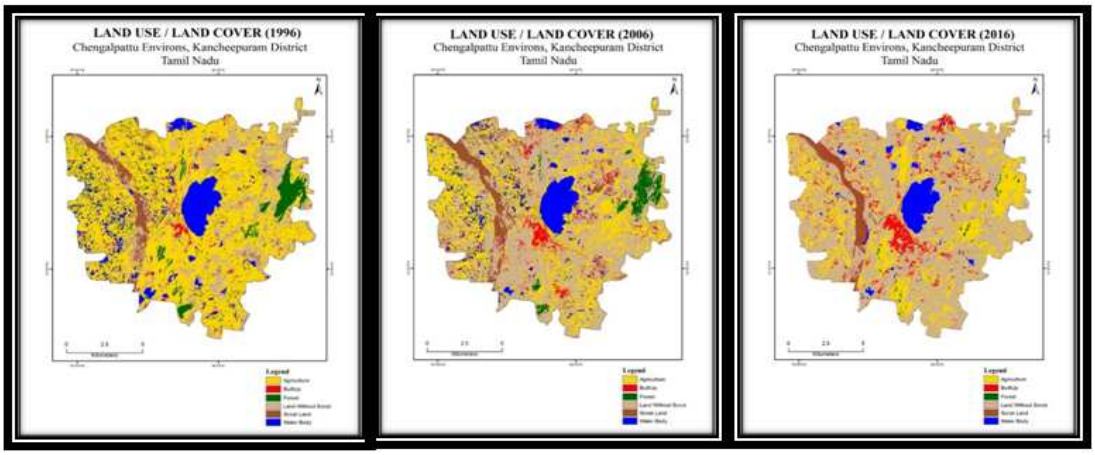

Figure 3: Land Use / Landover Classification - 1996

Source: Satellite Image analysis

Table 2: Land Use/Land Covers Statistics

LULC Classes	Area (in hectaes)		
	1996	2006	2016
Built Up	253.99	631.53	898.2
Forest	1067.46	726.12	93.33
Agriculture	9689	4776.66	3874.96
Scrub Land	944.94	949.95	714.34
Land without Scrub	3598.52	8773.02	10652.5
Water Body	1533.53	1230.12	854.12
Total	17087.44	17087.4	17087.45

A land use / land cover map has been prepared on the basis of NRSC Level II classification. The spatial resolution is 30 mts., while the radiometric resolution is 8 bit. To classify the Land use / Land cover supervised classification has been chosen. The area has been classified in six LULC classes. In which it is clear that agricultural land (57%) is the major dominating part in the study area, followed by land without scrub (21%), water body (9%), forest (6%) and scrub land (6%). Built up has covered in a few places and in a very less percentage (2%).A land use / land cover map has been prepared on the basis of NRSC Level II classification. The spatial resolution is 30 Mt while the radiometric resolution is 8 bit. To classify the Land use / Land cover supervised classification has been chosen. The area has been classified in six LULC classes. Land without scrub covers the largest portion (51%). Followed by agricultural land (28%), water body (7%), scrub land (6%), forest (4%) and finally built up (4%).A land use / land cover map has been prepared on the basis of NRSC Level II classification. The spatial resolution is 30 Mt while the radiometric resolution is 8 bit. To classify the Land use / Land cover supervised classification has been chosen. The area has been classified in six LULC classes. In 2016 the major land cover is land without scrub (63%), followed by agricultural land (23%), built up (6%); water body (5%), scrub land (4%) and forest cover (1%). The forest cover has been diminished drastically.

LAND USE / LANDCOVER CHANGE DETECTION – 1996-2016

Table 3: Land Use/Landover Change Detection 1996-2016

LULC Classes	Years		
	1996	2006	2016
Agriculture	56.7	27.9	22.6
Built Up	1.4	3.7	5.2
Forest	6.2	4.2	0.5
Water Body	8.9	7.2	5.0
Scrub land	5.5	5.5	4.1
Land without scrub	21.0	51.3	62.3
Total	100	100	100

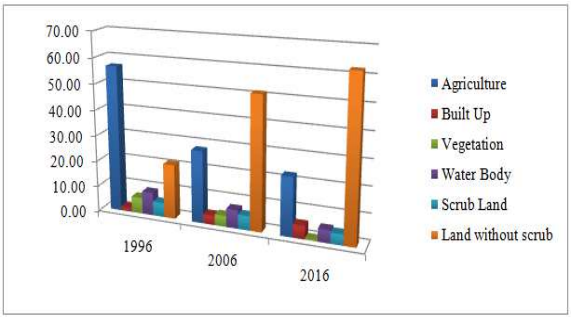

Figure 4: Graphs Showing the Land use/Land Cover Change Detection 1996-2016

Land use / land cover map shave been prepared on the basis of NRSC Level II classification for the years 1996, 2006 and 2016. The spatial resolution is 30 Mt while the radiometric resolution is 8 bit. To classify the Land use / Land cover supervised classification has been chosen. The area has been classified in six LULC classes, which are, Agriculture, Built up, Forest, Water body, Scrub land and Land with Scrub. A spatio-temporal analysis has been shown in a bar graph for twenty years (1996-2016), to analyse the changes of each land use / land cover categories over time. It can be clearly observed that there is a drastic change in the pattern and total area of agricultural land over the time period (from 57% to 23%). The natural vegetation (6% to 0.5%), water body (9% to5%) has been decreased as well during the period of time, whereas built up (1% to 5%) and land without scrub (21% to 62%) has been increased in terms of urban expansion. There is an inverse relationship between the growth of urban and the natural land cover percentage. With the expanding nature of urban the natural vegetation covers, water body is decreasing. One surprising fact is the portion of land without scrub has been increased drastically with the time period of 1996-2016. In case of agricultural land not only the total area but also the pattern of the cultivated land has been changed.

CHANGE MATRIX

One of the most common means of expressing classification accuracy is the preparation of a classification error matrix. Change matrices compare, on a category-by-category basis, the relationship between known reference data (ground truth) and the corresponding results of an automated classification. Such matrices are square, with the number of rows and columns equal to the number of categories whose classification accuracy is being assessed. It should be remembered that such procedures only indicate how well the statistics extracted from these areas can be used to categorize the same areas. If the results are good, it means nothing more

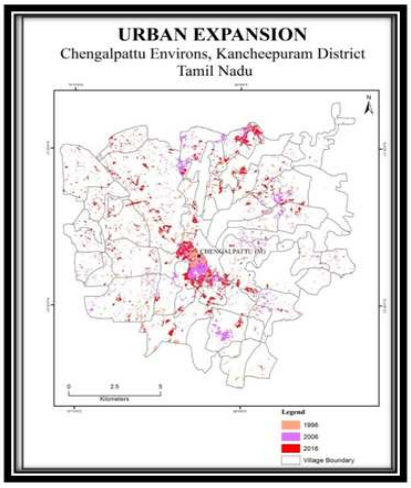

Figure 5: Urban Expansion

Than that the training areas are homogeneous and it can be applied for other same categories. The major changes in the years have been analysed with the help of satellite imagery under remote sensing and GIS technology. The major focus of the study is to understand the changes occurring in terms of change in land use practice, i.e. agricultural land has been transformed into Built up area. On the basis of this urban expansion map (on the basis of the urban area derived and calculated in LULC) has been generated.

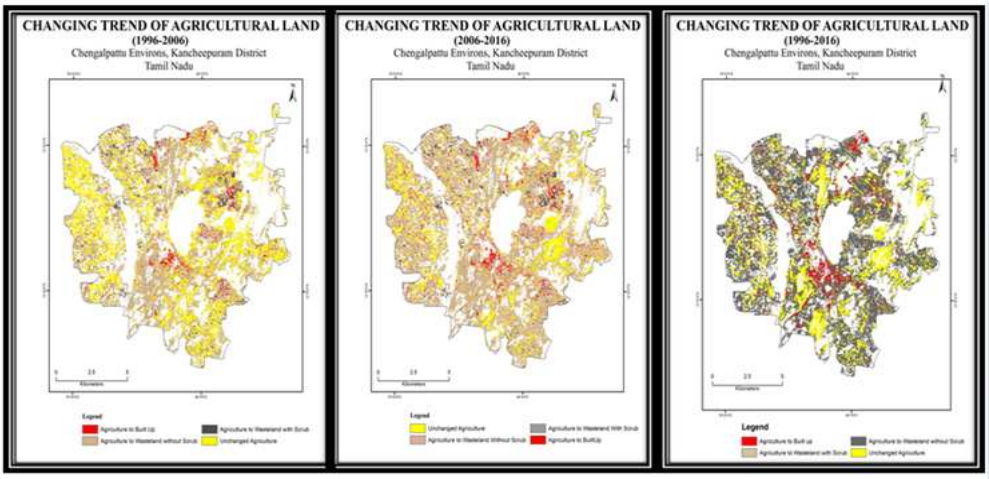

Figure 6: Changing Trend in Agricultural Land - 1996-2016

AGRICULTURAL SENSITIVITY ANALYSIS

Table 4: Changing Pattern of Agricultural land - 1996 -2016

LULC classes	Area in (1996-2006)		Area in (2006-2016)		Area in (1996-2016)	
	Hectare	(%)	Hectare	(%)	Hectare	(%)
Agriculture to Build Up	380.9	2.2	170.4	1	740.8	6
Agriculture to Wasteland without Scrub	5096.16	29.8	2810.3	16.4	6480.3	37.5
Agriculture to Wasteland with Scrub	283.31	1.7	15.2	0.09	61.4	0.4
Unchanged Agriculture	3338.84	19.5	1625.22	9.5	2260.4	13.2

The chart shows how agricultural land has been converted into built up land and wasteland during the process of urban expansion. The good fertile lands have been left uncultured for five or more years in order to declare the land as a wasteland or commonly known as fallow land. The environs of Chengalpattu are known for the paddy cultivation, followed by ground nut and gingely. The lands are fertile enough for cultivating for twice or thrice in a year depending upon the land quality and the availability of water. The cropping pattern is mostly twice paddy cultivation and one time gingili or ground nut. Sometimes, sugar cane is also being cultivated in some of the lands. Plantation is also common in this area. Banana and coconut is the most common product in this concern.

Table 5: Details of Major Crop Productivity Capacity / Acres

Major Crops	Production Per Acres
Paddy	30-55 packs (42.5)
Ground Nut	25 packs
Gingili	8 packs

Source: Field visit

Area and Production Loss in Paddy Cultivation

Concentrating on the paddy cultivation, total amount of cultivation per land is around 43 packs and depending upon the quality of rice the price of the rice the price varies from Rs.1, 400 to Rs.1, 700.

43 pack of paddy will be grown per acre (1pack consist of 75 kilograms), the price of one pack of paddy in the market is Rs.1, 500/-. The total cost of the paddy per acre is 43 * 1500 = 64,500/-

Due to the change in Agricultural land to built up and land without scrub land is around 5,496 hectares during 1996 – 2006 i.e. 13,580.9 acres. By the process of conversion of agricultural land in to other activities there is a loss of major crop Paddy production during the year 1996-2006 is 583978.7 packs. The economy of loss due to non-cultivating of Paddy in the study areas is around Rs. 87,59,68,695/- (13580.91 acres * Rs.64,500) in the whole study area (Chengalpattu environs).

Due to the change in Agricultural land, to built up and land without scrub land is around 2980 hectares, during 2006 – 2016 i.e. 7363.74 acres. By the process of conversion of agricultural land, into other activities there is a loss of major crop Paddy production, during the year 1996-2006 is 316640.8 packs. The economy of loss due to non-cultivating of Paddy in the study areas, is around Rs. 47, 49, 58650/- (7363.7 acres * Rs.64, 500), in the whole study area (Chengalpattu environs).

Due to the change in Agricultural land, to built up and land without scrub land is around 7220 hectares, during 1996 – 2016 i.e. 17841 acres. By the process of conversion of agricultural land into other activities, there is a loss of major crop Paddy production, during the year 1996-2006 is 767163 packs. The economy of loss due to non-cultivating of Paddy in the study areas, is around Rs. 115, 07, 50950 /- (17841acres * Rs.64, 500), in the whole study area (Chengalpattu environs).

Area and Production Loss in Groundnut Cultivation

If groundnut cultivated in the study area, a total loss of groundnut production will be around 339522.5 packs, from 13580.91 acres (13580.91 acres * 25 packs) for 1996-2006. There is total loss of production during the year 2006-2016 is aroung184093.5 packs from 7363.74 acres. All together from 1996 to 2016 the groundnut production lost about 446025 packs from 17841 acres.

Area and Production Loss in Gingili Cultivation

If gingili cultivated in the study area, a total loss of gingili production will be around 108647.2 packs from 13580.91 acres (13580.91 acres * 8 packs) for 1996-2006. There is total loss of production; during the year 2006-2016 is around 58904.3 packs from 7363.74 acres. Altogether, from 1996 to 2016, the gingili production lost about 142728 packs from 17841 acres.

POPULATION GROWTH TRENDS

Spread over an area of 6.09 sq. km Chengalpattu is the second largest town in the district of Kancheepuram, with a population of over 64Thousand. The income of the Municipality comes from sources like House Tax, Water Charge, Professional Tax, Non Tax etc. The income of main area of the Municipality comes from Periya Natham, Chinna Nahtam, Gundoor, Melamaiyur, Hanumanthapuhteri etc. It can be clearly observed from the above three maps, on how population has been increased over the period of time, from 1991-2001. Furthermore, the change in the distribution of population can be observed. Chengalpattu, being the main attraction of all the places, the migration from nearby villages are increasing, so in search of land parcels to accommodate the bigger population the fertile agricultural lands are being unutilised, converted into waste lands (declared) and sold to the buyer in a very high range. For example, 15 years ago, 1cent (100 cent = 1 acre) of land in Chnegalpattu was only 250 rupees, but now it has been increased to around 1 lakh rupees, for the same amount of area.

CONCLUSIONS AND SUGGESTIONS

Impact of Urbanisation

Chengalpattu started off as a Panchayat and became a town, with the inclusion of Periyanatham, Chinnanatham, Gundoor, Hanumanthaputheri and Melamaiyur villages. As per G.O.01.02.1972, Order no 169/01.04.1972 Sec-ond Grade Municipality and then after 12 years, another G.O. Order No599/17.04.84, First Grade Municipality. The hot and dry climate prevailing in this region has been one of the various factors

Chengalpattu Municipality and its environs are also facing this dramatic change in the total area of agriculture converted into Built up area. The overall change of each LULC classes has been changed in terms of urban expansion. Agricultural land has been decreased in a very rapid manner from 57% in 1996 to 23% in 2016, followed by forest cover from 6% in 1996 to 0.5 % only in 2016, water body from 9% in 1996 to 5% in 2016. Another major change can be observed in land without scrub (the land which are being uncultivated, in order to being converted into built up land later on). It was only 21% in 1996 which has been changed into more than 60% in 2016. Because of the change in land use pattern there is a change in the work force as well. The number of marginal workers has been increased where as the number of agricultural labourer or red collar labourer is been decreasing due to the expansion of urban. Although the total amount of built up is less but this is to be remembered that the area is expanding and the natural cover (vegetation, water body) area decreasing. Due to the shortage of residential lands the population has been started to build houses in the hilly regions as well.

Due to the increasing demand for land for industrial, housing and infrastructure development, the land put to non-agricultural uses has shown a sharp increase. Though the area under current fallows increased but most of the times they have been converted into residential, commercial or industrial purposes. One of the most disturbing trends is the sharp increase in other fallows. But in 2014 a policy was made by the Tamil Nadu Government that not only the secondary data sources but also ground truth verification is required in terms of consideration of wasteland in the area. In this process the uncultivated land, which cultivators have not been used willingly will be marked and those will not be declared as fallow land or wasteland. So there is a change in the pattern of agriculture practice. During the field visit it was observed that many of the lands has been transformed to built up land but the construction is being stopped and declared as disputed land.

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