

# Suburban Changes In Salem By Using Remote Sensing Data

<sup>1</sup>T.Subramani, M.Sivagnanam<sup>2</sup>

<sup>1</sup>Professor & Dean, Department of Civil Engineering, VMKV Engg. College, Vinayaka Missions University, Salem, India

<sup>2</sup>PG Student of Environmental Engineering, Department of Civil Engineering, VMKV Engg. College, Vinayaka Missions University, Salem, India

## ABSTRACT

*Remote Sensing of Urban and Suburban Areas'' provides instructors with a text reference that has a logical and easy-to-follow flow of topics around which they can structure the syllabi of their urban remote sensing courses. Topics have been chosen to bridge the gap between remote sensing and urban studies through a better understanding of the science that underlies both fields. Emphasis is placed on: theoretical and practical issues in contemporary urban studies and remote sensing; the spectral, spatial and temporal requirements of remotely sensed data in relation to various urban phenomena; methods and techniques for analyzing and integrating remotely sensed data and image processing with geographic information systems to address urban problems; and examples of applications in which applying remote sensing to tackle urban problems is deemed useful and important.*

**Keywords:** Suburban, Changes, Salem, Using, Remote Sensing, Data

## 1.INTRODUCTION

### 1.1 General

It is experiencing a rapid urbanization. Urban growth and sprawl has severely altered the biophysical environment. Land-use and land-cover change, as one of the main driving forces of global environmental change, is central to the sustainable development debate. Land use and land-cover changes have impacts on a wide range of environmental and landscape attributes including the quality of water, land and air resources, ecosystem processes and function, and the climate system itself through greenhouse gas fluxes and surface effects. Land use and land cover change has been reviewed from different perspectives in order to identify the drivers of land use and land cover change, their process and consequences. Urban growth, land use and land cover change study is very useful to local government and urban planner for the betterment plan of sustainable development But, its benefits are increasingly balanced against ecosystem impacts, including degradation of air and water quality and loss of farmland and forests, and socioeconomic effects of economic disparities, social fragmentation and infrastructure costs. The history of urban growth indicates that urban areas are the most dynamic places on the Earth's surface. In India as well as in most developing countries, the excessive growth in population and the increased trend towards urbanization have led to many evils such as haphazard growth of industries, unplanned housing and utility networks, conversion of precious agricultural and forest land into urban land etc. Conventional ground methods of land use mapping are labour intensive, time consuming and are done relatively infrequently. These maps soon become outdated with the passage of time, particularly in a rapid changing environment.

The fundamental problem involved in producing accurate land use maps of urban areas arises from the fact that urban areas are complex assemblages of a disparate set of land cover types including man-made structures, vegetation and water bodies – each of which has different spectral reflectance characteristics. In visual analyses of remotely sensed images the spatial pattern of these land cover types is often used to distinguish between categories of urban land use. Urban areas are regions with a high level of spatial dynamism where their size is rapidly increasing. Urbanization is one of the most evident human-induced global changes worldwide. In South Africa, urbanisation levels reached 56% in 2001, resulting in a 4.3% increase from 1996 to 2001. The growth of urban areas depends on numerous factors including social, economic, demographic, environmental, geographic, cultural, and others. Therefore, modeling such a dynamic system is a challenging task. Population growth is one of the most important factors that contribute to any urban system change. The expansion of a city beyond its periphery requires population growth spatially distributed. Growth in population contributes to urban change by absolute growth, which increases urban areas, and changes the dynamics of urban demography. Of that urban population, the numbers residing in small cities generally swells at a striking rate, and in parallel, there is usually an associated decrease in household sizes and a related increase in the number of housing units. Remote sensing (RS) and Geographic Information Systems (GIS) techniques are some

geospatial tools being widely used to assess natural resources and monitor spatial changes. Land use/cover (LULC) change dynamics can be analysed using time series remotely sensed data and linking it with socio-economic or biophysical data in GIS.

### **1.2 Significance Of The Study**

Urban land use change studies are important tools for urban or regional planners and decision makers to consider the impact of urban sprawl. The results of this study would provide information relevant to contribute in the environmental management plans and improve urban planning issues.

1) Provide information on the status and dynamics of the urban land use of the area and the use of remote sensing from satellite imagery for such analysis for planners. Assist environmentalist, regional (urban) planners, and decision makers to consider the potential of geospatial tools for monitoring and planning urban environment.

2) Provide elements for long term bench-mark monitoring and observation relating to resource dynamics.

3) Provide a base line for eventual research follow-up, by identifying specific and important topics that should be considered in greater detail by those interested in the area. Urban sprawl and growth information are relevant to variety of people, agencies etc. for decision making. Among these users are both government and non-governmental agencies.

### **1.3 Suburban Growth And Sprawl**

Urban growth varies in definition across countries and fields of studies. It shall be considered for this review as the increasing physical transformation of urban land into other structures such as buildings in response to population increases. It could be planned or unplanned. This review focuses on the unplanned growth, also referred to as sprawl. Urban sprawl refers to uncontrollable, irresponsible and poorly planned expansion of an urban area into rural land destroying green spaces, increasing traffic, contributing to air pollution, leading to congestion with crowding and does not contribute significantly to national income. The direct implication of urban sprawl is change in land-use and land-cover of the region since sprawl induces an increase in built-up and paved areas. Urban sprawl can be considered a significant and growing problem that entails a wide range of social and environmental issues.

Researchers have been challenged with the definition of urban sprawl as it can be considered from different perspectives. Sprawl may either refer to: certain patterns of land use, or processes of land development, or causes of particular land-use behaviours or consequences of land-use behaviours. Urban sprawl can be measured through the use of indicators selected according to the specific area of study. These indicators include low-density or single-use housing; development at substantial distance from urban areas; development in radial, stripped or isolated emanating from urban areas; development into protected or agricultural land and others.

### **1.4 Land Use And Land Cover Types**

The various land use and land cover categories in Salem are listed below: Agricultural land which consists of shrub land, grass/herb, dense/grass fallow.2) Forest consisting of closed forest, open forest and reserve forest.3) Urban areas.4) Bare land.5) Water bodies. 6) Unclassified lands.

### **1.5 Objectives**

The principal aim of this research was to apply remotely sensed data, geospatial tools to detect, quantify, analyze, and forecast urban land use changes.

1. Quantify and investigate the characteristics of urban land use over the study area based on the analysis of satellite images.

2. Identify whether there have been and will be significant urban land use changes.

3. To analyze the land use and land cover pattern for the specific periods.

4. To detect land use and land cover pattern for the study period.

5. Analyze the specific issues of the urban environment and put forward a recommendation or set of recommendations that may form the basis for a sound solution for sustainable land management.

## **2. STUDY AREA**

### **2.1 General**

Salem District is a district of Tamil Nadu state in southern India. Salem is the district headquarters and other major towns in the district include Mettur, Omalur and Attur. Salem is surrounded by hills and the landscape dotted with hillocks. Salem has a vibrant culture dating back to the ancient Kongu Nadu. As a district, Salem has its significance in various aspects; it is known for mango cultivation, silver ornaments, textile, sago industries and steel production. As the district had a population of 3,482,056. Salem is one of the biggest cities in Tamil Nadu. Salem District is one of the land locked Districts in Tamilnadu. It is bounded on the North by Dharmapuri district, on the South by Namakkal district, on the West by Erode district and, on the East by Villupuram district (Fig.1). The elevation of landscape generally ranges from 500 ft to 1200 ft. above MSL with the exception of Yercaud which is at 5000 ft. above MSL. The Geographical area of the district is 520530 Ha. There are two major bus stations in Salem : MGR Integrated Bus Terminus (Central Bus Stand) located in the Meyyanoor area and Town Bus Station (Old Bus Stand) which is located in the Town Area in the heart of Salem. All mofussil, intercity and interstate routes originate from Central Bus Stand, while town buses originate from town bus stand. Anna Flyover situated near GH is oldest flyover in the City. Trumpet

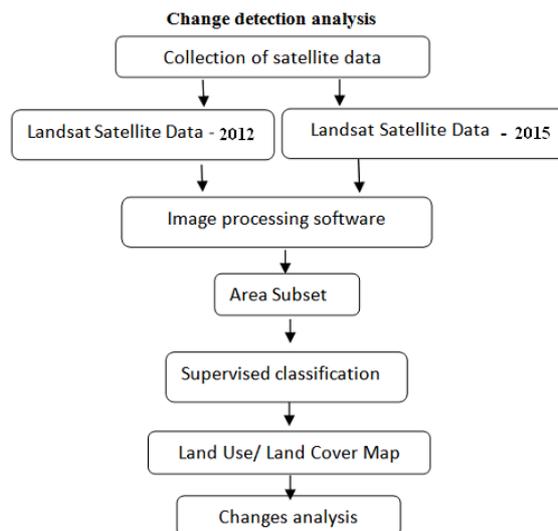
Interchange was constructed in the new alignment of NH 47 to ease the traffic movement towards Coimbatore and Cochin.

### 2.2 Geographical Information

The geographical extension is North Latitude Between 11 14` and 12 53` East Longitude Between 77 44` and 78 50`. Salem is a city and a corporation in Salem district in the Indian state of Tamil Nadu, located in the north central part of the southernmost state of India. It is the 5th largest Municipal Corporation and Urban agglomeration in Tamil Nadu next to Chennai, Coimbatore, Madurai and Trichy. Salem is a part of the Kongu Nadu, an ancient division of Tamilakam comprising the western Tamil Nadu. Almost completely surrounded by hills, Salem is at the base of the renowned tourist destination of Yercaud hills, which offers breathtaking views both along the ride up the hill and from the peak. There are also remote sites of beauty such as Kiliyur falls and Kavery peak. Yercaud is at an altitude of 1600 m above mean sea level. The city is surrounded by hills on all sides: the Nagaramalai to the north, the Jarugumalai to the south, the Kanjamalai to the west, and Godumalai to the east. It is divided by the river Thirumanimuthar in the main division. The fort area is the oldest part of the town. It is also important to state that Salem city and its environs which were carved out using the local government boundary map and Salem city Administrative map was also obtained from Salem corporation office. Topographic map at a scale of 1:50,000 for 2012. The data were acquired from the Survey Department, Chennai, India.

### 3. METHODOLOGY

The present study involves the collection of Toposheet, city map from relevant authorities. The required satellite imagery for the study area is to be down loaded from the USGS Earth Explorer. Processing the imagery and image interpretation for development of Land use and Land cover maps is to be done. The obtained maps are to be studied and analyzed to detect the change in urban expansion and urban sprawl. Flow chat for methodology on change detection analysis is shown in Figure.3.1



**Figure.3.1** Flow chat for methodology on change detection analysis

#### 3.1 Remote Sensing

Remote sensing, in simplest terms, means viewing something from a distance rather than by direct contact. A handheld camera is an example of a remote sensing instrument. In terms of earth science, remote sensing refers to the ability of satellites to detect electromagnetic radiation from features on the earth's surface or in the atmosphere. Solar energy that reaches the earth is composed of many kinds of radiation, including light that is visible to people, thermal infrared, microwave, radar, and X-rays. Every substance with a temperature greater than absolute zero (-273 degrees Celsius, or -459 degrees Fahrenheit) emits some form of electromagnetic radiation. Some satellite sensors detect visible light reflected from the earth's surface or atmosphere, and others detect radiation emitted from the earth. Satellites can easily measure sea ice in the visible, infrared, and microwave regions of the electromagnetic spectrum. However, there are advantages and disadvantages to each type of radiation. None of the spectral regions allow scientists to optimally view sea ice in all conditions. The following sections describe each region in more detail. Remote sensors can be either passive or active. Passive sensors respond to external stimuli. They record radiation that is reflected from Earth's surface, usually from the sun. Because of this, passive sensors can only be used to collect data during daylight hours. In contrast, active sensors use internal stimuli to collect data about Earth. For example, a laser-beam remote sensing

system projects a laser onto the surface of Earth and measures the time that it takes for the laser to reflect back to its sensor

### **3.2 Application Of Remote Sensing**

- **Coastal applications:** Monitor shoreline changes, track sediment transport, and map coastal features. Data can be used for coastal mapping and erosion prevention.
- **Ocean applications:** Monitor ocean circulation and current systems, measure ocean temperature and wave heights, and track sea ice. Data can be used to better understand the oceans and how to best manage ocean resources.
- **Hazard assessment:** Track hurricanes, earthquakes, erosion, and flooding. Data can be used to assess the impacts of a natural disaster and create preparedness strategies to be used before and after a hazardous event.
- **Natural resource management:** Monitor land use, map wetlands, and chart wildlife habitats. Data can be used to minimize the damage that urban growth has on the environment and help decide how to best protect natural resources.

### **3.3 Aerial Photography**

Aerial photography has two uses that are of interest in class exercises: (1) collection of detailed measurements from aerial photos in the preparation of maps; and (2) to determine land-use, environmental conditions, and geologic information (outcrop locations, lineation, etc). It should be noted that aerial photographs are NOT maps. Maps are orthogonal representations of the earth's surface, meaning that they are directionally and geometrically accurate. Aerial photos often display a high degree of radial distortion that must be corrected. Most GIS packages have some mechanism or work flow for correcting this distortion (see georeferencing) or you make an effort to find corrected data online.

#### **3.3.1 Types Of Aerial Photography**

- **Black and White:** Older and lower cost surveys are collected on black and white media and coverage over the U.S. is essentially complete. Multiple generations are ideal for comparing for recent change detection of the land surface.
- **Color:** More recent or higher cost aerial photo surveys are on color media and coverage over most key areas of the US are available but not always at zero cost.
- **Infrared:** Primary use is vegetation studies as vegetation is a very strong reflector of infrared radiation.

### **3.4 Satellite Imagery**

Satellite imagery is collected by a host of national and international government, and private agencies. Most of this data is protected by copyright and use access has to be negotiated by individual users or institutions. Free access is possible through collaboration with NASA and NASA funded institutions. Data products span the useful electromagnetic spectrum in a variety of resolutions and it falls upon the instructor to consider the utility of this data in the instructional environment. In many cases, free or low-cost data has a resolution cell size greater than 100m/pixel thus this type of imagery often provides a big-picture regional view but may not provide detailed insight to geologic features found on the ground. Nonetheless, this type of data can be very useful in multi-scale analysis and to help students gain an appreciation for the scale of features on the ground that can have a substantial influence on the bulk reflectivity collected during satellite flyovers.

#### **3.4.1 Types Of Satellite Digital Imagery**

Remotely sensed satellite data comes in two basic types, passively collected data and actively collected data. Passive data collection focuses on acquiring intensities of electromagnetic radiation generated by the sun and reflected off the surface of the planet. Active data collection is largely restricted to devices that send and generate a pulse of energy to that is reflected back to the satellite to be recorded. Most of the readily available data is passively collected and is limited to energy not absorbed by the Earth's atmosphere. Satellite imagery based on passive reflectivity comes in 4 basic types, which are visible, infrared, multispectral, and hyperspectral. The type and resolution of the data that is collected is generally keyed to the mission of the satellite. Visible data consists of pixels composed of color values of red, green, and blue to make three bands of data on a raster image. Infrared imagery usually consists of the images that

include the visible channels as well as some range of the infra-red spectrum. Multispectral data include up to 7-12 channels of data and hyperspectral can be up to 50 bands or more of data collected over discrete bandwidths of the electromagnetic spectrum. How all of this data is used goes beyond the scope of this site, but it's worth keeping in mind that there are a range of available products and it may require a great deal of research to determine what type of data is useful in the context of the field based exercise.

### **3.4.2 Sources Of Satellite Digital Imagery**

Much of the available data can be purchased from a number of commercial sources. One of the best ways to have wide ranging access to NASA related imagery is to collaborate with a NASA scientist. The Jet Propulsion laboratory offers a range of educator resources for individuals who participate in their Higher Education Faculty Program. Other sources suitable for field mapping exercises include the NASA hosted GeoCover Site, which provides imagery through the MrSid format. The National Geologic Map Database provides a help page for working with MrSID images. Additional information on using imagery from the GeoCover site (a.k.a. Zulu) can be found at a GIS online tutorial hosted by the Rocky Mountain Mapping Center of the U.S. Geological Survey. The US Geological Survey provides a informative site dedicated to the Landsat program. Scenes can also be ordered from the USGS EROS site .

### **3.5 Data Collection**

We have collected the Toposheets of Salem of scale 1:50,000 with number 65 D/10. We have collected the city plan and data from the Salem municipal corporation. Land sat Images were collected from official web site of USGS. Land sat I Multi Spectral Scanner satellite image (MSS) with path /row 153/49 of the year 2012 and Land sat VIII Operational Land Imager Thermal Infrared Sensor (OLI-TIRS) Image with path/ row 142/49, of the year 2014 has been down loaded from Earth explorer web site of USGS. The Salem city located in Krishna district falls under the Zone 44.

## **4.DESIGN**

### **4.1 General**

For this study Landsat satellite images of salem city were acquired for five Epochs; Landsat 2012, and LISS-III 2015. The Epochs of 2012 is obtained from Global Land Cover Facility (GLCF) an Earth Science Data Interface, while that of 2015 was obtained from National Remote Sensing Centre, Hyderabad. The Landsat data were acquired from the global land-cover website at the University of Maryland, USA, URL; <http://glcfapp.umiacs.umd.edu:8080/esdi/index.jsp>. The satellite data were different resolutions but these all converted into 30m spatial resolutions. It is also important to state that Salem city and its environs which were carved out using the local government boundary map and Salem city Administrative map was also obtained from Salem corporation office. Topographic map at a scale of 1:50,000 for 2012. The data were acquired from the Survey Department, Chennai, India. The software programs have been used in this study to process, quantify, analyze and model the spatial dataset. For the preliminary data processing, extracting the study area and mosaicing satellite images, ERADAS 9.3 and Arc GIS 9.2- version was used.

### **4.2 Remotely Sensed Data For Change Detection**

Remote sensing is characterized by spatial, temporal, and spectral heterogeneity of urban environments. It is irrefutably a modern science, which studies the earth's changing environment, through remote sensing tools such as satellite imagery and aerial photographs. It is an appropriate source of urban data to support studies of urban growth as it provides a unique perspective on growth and land-use change processes. Effective analysis and monitoring of land cover changes require a substantial amount of data about the Earth's surface. This is most widely achieved by using remote sensing tools. Remote sensing provides an excellent source of data, from which updated LULC information and changes can be extracted, analysed, and simulated efficiently. Monitoring these changes and planning urban development can be successfully achieved using multi-temporal remotely sensed data, spatial metrics, and modelling. Remote sensing data derived from satellite sensors such as Landsat can provide information about the areal extent, conditions, boundary and monitoring of urban changes.

## **5 ANALYSIS**

The data sets were analyzed with following ways for this study:

The ultimate objective of the research is to detect the land use/land-cover change of Salem city from 2012 to 2015. Satellite images of Salem city at different periods 2012, 2013, 2014, and 2015 were analysed.

### **5.1 Suburban Area For 2012**

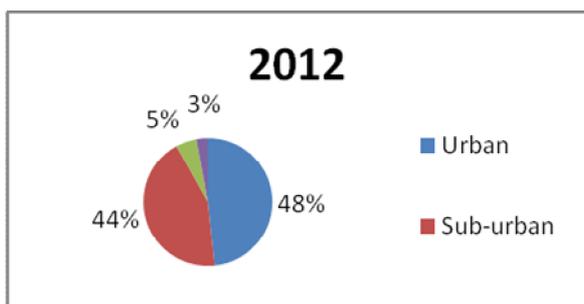
The land use and land cover pattern based on unsupervised classification for 2012 is given in Figure.5.1 and Figure.5.3. The highest level occupied was Sub urban of 7628 acres with 30.20% and the lowest level occupied was tanks area of 223.56 acres with 0.64%. The area occupied for the tank it was 223.56 acres with 0.64% in 2012 and the river occupied area is 324.56 acres with 1.26%. The Barren and rocky surface land occupied area was 2080.28 acres with 4.10%

**5.2 Suburban Area For 2015**

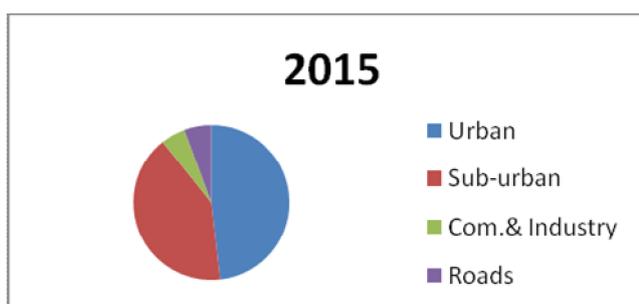
The land use and land cover pattern for 2015 is given in Figure.5.2 and Figure.5.4 .The highest level occupied was Sub-urban area of 8436 acres with 30.48 % and the lowest level occupied was river area of 420.18 acres with 3.64%.The above table reveals for the land use and land cover pattern for 2015 the Salem city. The urban area occupied an area of 11245 acres with 35.78% in and the sub-urban area was 8436 acres with 30.48%. The commercial and industrial activity as the part of urbanization. The area occupied for this category was 428.62 acres with 3.78% and the roads covered with 638.56 acres of 4.20 %. It was 168.75 acres with 1.86 % to dedicate mining activities for the great demand of minerals in and around the district. The analysis reveals that the crop land and plantation part was 3725 acres with 25.20% and the land with shrub area was 1848 acres with 13.58 %. The scrub forest was occupied 328.42 acres with 2.10 % and the fallow land was 127.36 acres with 8.40 %. The area occupied for the tank it was 352.14 acres with 2.15% and the river occupied area is 420.18 acres with 3.64%. The Barren and rocky surface land occupied area was 2407.28 acres with 11.45%.

**5.3 Land Use And Land Cover Change 2012-2015**

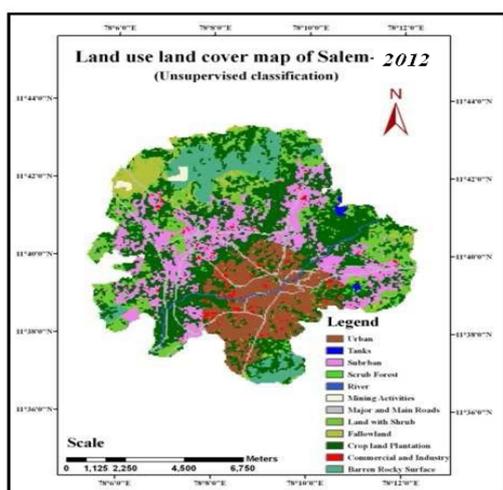
The land use and land cover changes are detected from the images of 2000 and 2015. The changes are given below in change detection map (fig.7.9 & table 7.7&7.8) and this clearly reveals the changes have taken during this period. The software programs that have been used in this study to process, quantify, analyze and change detection are ArcGIS 9.2, ArcMap and ERADAS 9.3. The change detection procedure, however it was able to identify the areas of significant change. The seasonal variation of the two satellite images used in the analysis affected the spectral resolution which subsequently affected the change detection process. Because of the variation of the temporal resolution and other environmental factors, the same land cover class can have different radiance values between the images. It can be concluded from the resulting statistics that the image-to-image change detection was more accurate that the post-classification comparison.



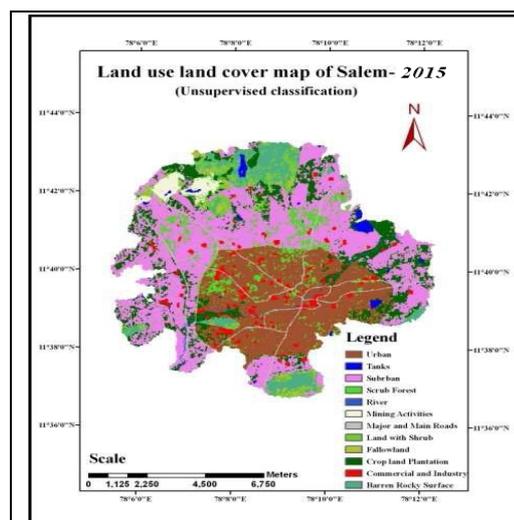
**Figure.5.1** Pie-chart- Land use and land cover for 2012.



**Figure.5.2** Pie-chart- Land use and land cover for 2015.



**Figure. 5.3** Suburban area in 2012



**Figure.5.4** Suburban area in 2015

**5.3.1 Urban**

The urban area was occupied with 8688 acres and 11245 acres in 2012 and 2015 respectively. The total change of urban areas with built-up was 2557 acres with the increase of 29.43 % in 4 years of period. The peripherals and urban fringe have turned as urban and hence urban area is extended.

### **5.3.2 Sub-Urban**

The sub-urban area was 7628 acres in 2012 and it had increased to 8436 acres in 2015 with the change of 808 acres in 4 years with increase of 10.59 %. The growth of Sub-urban area is except in the northern part the city and particularly leaving the mining area, all other area concentrated.

### **5.3.3 Barren Rocky Surface**

It has been increased with an area of 327 acres of 15.71% from 2012 to 2015. The occupied area was 2080.28 acres in 2012 and it was 2407.28 acres in 2015. The change area is occurred due to new educational institutions and emergence of small scale industries too. This category area includes are Vellakaipatti, North of Burns colony, West Gorimedu and Chetichavadi area. Change detection technique of post classification comparison (indirect method) and image-to-image comparison change detection (direct method) were employed. In the indirect method, both supervised and unsupervised classifications were performed. The Unsupervised classification proves to be better than the supervised classification with accuracies of 98%, 99%, 98.33%, 98.67% and 98.67% for 2012, 1980, 1990, 2000 and 2015 classified images are respectively. Post-classification comparison change detection was conducted to reveal the areas that have changed over the period of 37 years. In this method, the from-to-change informational classes were available. The results revealed drastic growth of urban areas and reduction of Barren Rocky Surface, Fallow land, Crop & Plantation, Land with Shrub and River.

### **5.4 Remote Sensing Analysis And Modelling Of Sub Urban Change**

Understanding the suburban patterns, dynamic processes, and their relationships is a primary objective in the urban research agenda with a wide consensus among scientists, resource managers, and planners, because future development and management of urban areas require detailed information about ongoing processes and patterns. These patterns can be systematically mapped, monitored and accurately assessed from satellite data along with conventional ground data. RS and GIS techniques may be used as efficient tools to detect, assess and map land use changes. In order to detect and evaluate urban changes, applied image differencing, principal component analyses as well as fuzzy ARTMAP for classification. Results for the different dates are compared which reveal significant changes. For predictions into future scenarios, the combined CA with Markov chain analysis was employed.

The built-up area in an urban setting is generally considered as the parameter of quantifying urban sprawl. It is quantified by considering the impervious or the built-up as the key feature of sprawl, which is delineated using toposheets or through the data acquired remotely. Shannon's entropy, which reflects the concentration of dispersion of spatial variable in a specified area, to measure and differentiate types of sprawl. The measurement is based on the notion that landscape entropy or disorganisation increases with sprawl.

The spatial phenomenon in urban growth modelling is simulated geometrically using techniques of CA. The CA technique is used extensively in urban growth models and simulation. The challenge is that the models fail to interact with the causal factors driving the sprawl such as the population growth, availability of land and proximity to city centres and highway. This method was challenged in not being able to spatially pinpoint accurately where sprawl could occur. This challenge could be addressed by applying neural network to remotely sensed data especially for classification and thematic representation.

### **Cellular Automata**

Urban growth modelling is getting more attention as an emerging research area in many disciplines. This is because of the recent dramatic increase in urban population that has increased pressure on infrastructure services (Batty, 2005). In recent years, there has been a prolific application of CA models to urban systems. The models are impressive in terms of their technological evolution in connection to urban applications (Yang and Lo, 2003). CA enables the understanding of the urbanization phenomenon and the exploration of what-if scenarios. It constitutes a possible approach to urban growth modelling by simulating spatial processes as discrete and dynamic systems in space and time that operate on a uniform grid-based space (Araya and Cabral, 2010). The ability of CA to represent complex systems with spatio-temporal behaviour, from a small set of simple rules and states, makes it suitable for modelling and investigating urban environments (Tewolde and Cabral, 2011). CA simplifies the simulation of complex systems wherein basic elements of the city are represented in two distinct but related ways: through cells which represent the physical and spatial structure of the city, and through agents, which represent the human and social units that make the city work (Cabral and Zamyatin, 2006). CA models are attractive for simulating urban systems since local action gives rise to global forms emerging spontaneously with no hidden directives for the macrostructures. CA algorithm offers an interesting and innovative approach for simulation of urban systems.

### **5.5 Suburban Sprawl From 2012 To 2015**

It clearly reveals from the figure (8.5) that the expansion of city with different clusters sprawled from North West to north and till north east. It appears like Arc shape covering the areas are Engineers colony, East railway colony, West railway colony, Sunder nagar, Solam pallam, Gorimadu, Jaya nager, Verma Garden, Chinna gollapatti, N.G.O. Colony, Thathampatti, S.K Town ship, Dharmanagar, Kennady nagar, Palaniyappa nagar, Tata colony, Arthanari nagar Rail way police quarters, Subramaniya nagar, Ramalinga nagar, Vellakal patti. Periya gollapatti, Chinna thirupathi, SCCB Colony, Johnsonpet, Kumarasamy patti and Kamarajar nagar.colony, Periyapudur, LRN colony, Hasthampatti, Alagapuram, Swarnapuri, SIDCO Industrial Estate, Narasothipatti, Jagir Ammapalayam, Suramangalam, Mayyanur

and Burns colony the black colour cluster 2012-80 of now became a core of the city which were the clusters of urban fringe and out of core city. In the same yellow and green colour represented for 1980-1990 and 1990-2000 respectively, now it has become core or adjacent to core of the city.

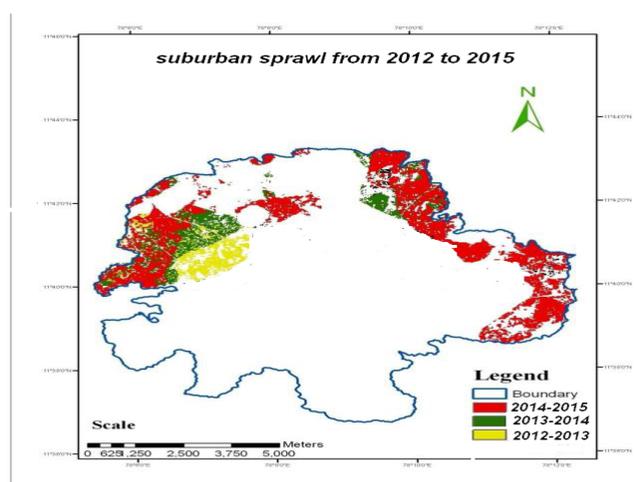
Finally the red colour represented in the figure is for the recent decade of 2000-2015 and its sprawl of urban. In which it is noticed that the northern part of the city extended from north to north-east formed the cluster witnessing the recent growth of the city. This made the increase of living cost and land cost. So the urbanization of Salem city is mainly towards the north direction due to good transport facility, sufficient space for housing, institutions and industries, Extension services of buses with increased number of frequency, business extension counters and nearer to the producers of agricultural products so as to get the commodities at the reasonable price. Besides these, the migrant from villages and other parts of people who choose for their residents and urban labours like to reside in the peripherals of city as the result of their low wage or salary which could not allow them to stay within the core city.

### 5.5.1 Analysis

Suburban or built-up area has been increased by 3 times in the span of 40 years and most of the built-up area spread parallel. There is little development perpendicular to the stretch parallel. There is lot of scope for urban development in this direction. The remarkable increase in the light vegetation or grass land indicates the conversion of agricultural lands to sites for real estate. This land covered with soil develops grass and other light vegetation before any construction taken place in that area. The decrease in barren area is due to the construction of residential buildings. The reduction in greenery and increase in built-up area may cause the urban environment un-sustainable. This is mainly due to the development of urban heat island, accumulation of solid wastes, increase in noise pollution, surface runoff drainage problems etc. Proper planning is required to manage the urban environment so that the city dwellers do not face discomfort. Development of greenery through social forestry, development of green belts on either side along the road lines, restriction on conversion of agricultural area in to construction site are some of the measures that can be helpful for sustainable development of the city.

## 6.RESULTS AND DISCUSSION

Suburban growth is an unstoppable process in development which can only be managed through proper planning. The planning process can only start by identifying the growth points within urban areas. Satellite remotely sensed data has proven essential in this identification and mapping process of such growth. Advances in satellite-based land surface mapping are contributing to the creation of considerably more detailed urban maps, offering planners better understanding of urban growth dynamics and sprawl. Recently, the implementations of these techniques to quantify analyse, and model the urban growth dynamics has been successful as illustrated by this review. Therefore being useful to town and regional planners.



**Figure.6.1** Suburban sprawl from 2012 to 2015

The suburban sprawl (Figure.6.1) is seen as one of the potential threats to sustainable development where urban planning with effective resource utilization and allocation of infrastructure initiatives are key concerns. This study attempted to identify such urban sprawls change for 2012-2015. The land use land cover maps of the study area are developed by supervised classification of the images. Four land use classes have been identified: Urban (Built-up), Light vegetation Information on land use / land cover and possibilities for their optimal use is essential for the selection, planning and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population. Land use and land cover change dynamics has been one of the topics when dealing with spatial

dynamics. Salem corporation of Tamil Nadu, India has increased in size and population as a result of many social-economic factors notably urbanization and industrialization. The seasonal variation of the two satellite images used in the analysis affected the spectral resolution which subsequently affected the change detection process. Because of the variation of the temporal resolution and other environmental factors, the same land cover class can have different radiance values between the images. It can be concluded from the resulting statistics that the image-to-image change detection was more accurate than the post-classification comparison.

## **7.RECOMMENDATIONS**

- 1)After the initial reduction in crop; and, land with shrub, fallow land, river area and barren and rocky surface between 2012 and 2015, the city has witnessed a steady growth in this class and indeed, may continue in this trend in future. For this projection to be realistic, it is suggested here that a deliberate attempt should be made by the city corporation and the state government to achieve this, since this will lead to many social crimes.
- 2)Real estate business should be abolished it should be operated by the respective state government would help the people to buy at the actual cost of the land there will not be any hidden cost so that many will like to outskirts of the city when they get spacious and cheaper rate.
- 3)Industrial and its allied activities should be prohibited within the city so that it would move to outskirts along with its workers so as to get additional space for other important administrative offices could be established within the city.
- 4)It is recommended that different image processing techniques should be employed in order to compare the results and to detect mistakes in the analysis. For urban change detection testing, different combinations of indices and sensors could also be of interest. Improving the classification process is also interesting area of further investigation.
- 5)Application of remote sensing and GIS was found helpful in quantifying past and present resources so that appropriate planning could be made for the future. It is therefore assumed that future development activities will cause much unfavorable environment in the urban. Hence the present study surely will help the planners to take appropriate steps to have healthy growth of Salem city.
- 6)Land use land cover changes have both favorable and unfavorable impacts. In order to get comprehensive, pragmatic and scientific measures to monitor this phenomenon, interdisciplinary approaches should be employed. Geographic information system and Remote sensing technologies are versatile tools which cannot be ignored in monitoring land use and land cover change. However, the availability of these technologies is not just enough but there is the need for an accurate processing of remotely sensed data as any error introduced into the image processing procedure will propagate to the final analysis. It is recommended that different image processing techniques should be employed in order to compare the results and to detect mistakes in the analysis. For urban change detection testing, different combinations of indices and sensors could also be of interest. Improving the classification process is also interesting area of further investigation. The bare open fields caused false urban changes and these could be minimized by using more frequent data covering growth seasons.
- 7)One who wish to sell the land has to obtained land value certificate along with registration documents to report to registering authority and the same to be paid by the buyer through the authority too, which will be monitored with appropriate authority so as to get everyone individual house/own house and avoid the spread of slums.

## **REFERENCES**

- [1]. K. C. Seto, C. E. Woodcock, C. Song, X. Huang, J. Lu And R. K. Kaufmann (2002), Monitoring land-use change in the Pearl River Delta using Landsat TM, *Int. J. Remote Sensing*, Vol. 23, No. 10, 1985–2004.
- [2]. J.Li and H.M.Zhao, (2003), Detecting Urban Land Use and Land Cover Changes in Mississauga using Landsat TM images, 2(1), 38-47.
- [3]. Subramani.T, Krishnamurthi.P, “Geostatistical Modelling For Ground Water Pollution in Salem by Using GIS”, *International Journal of Engineering Research and Applications*, Vol. 4, Issue 6( Version 2), pp.165-172, 2014
- [4]. Subramani.T, Manikandan.T, “Analysis Of Urban Growth And Its Impact On Groundwater Tanneries By Using Gis”, *International Journal of Engineering Research and Applications*, Vol. 4, Issue 6( Version 2), pp.274-282, 2014
- [5]. Subramani.T , Vishnumanoj.V, “Land Use and Land Cover Change Detection and Urban Sprawl Analysis of Panamarathupatti Lake, Salem”, *International Journal of Engineering Research and Applications*, Vol. 4, Issue 6( Version 2), pp.117-127, 2014.
- [6]. Subramani.T, Sivakumar.C.T, Kathirvel.C, Sekar.S,” Identification Of Ground Water Potential Zones In Tamil Nadu By Remote Sensing And GIS Technique” *International Journal of Engineering Research and Applications* , Vol. 4 , Issue 12(Version 3), pp.127-138, 2014.

- [7]. Subramani, T. "Identify Different Types Of Road Improvement Projects And Estimate Total Fund Required For Implementation" International Journal of Engineering Research and Applications, Vol.2, Issue.3, pp 267-273, 2012.

## **AUTHOR**



**Prof. Dr.T.Subramani** Working as a Professor and Dean of Civil Engineering in VMKV Engg. College, Vinayaka Missions University, Salem, Tamilnadu, India. Having more than 25 years of Teaching experience in Various Engineering Colleges. He is a Chartered Civil Engineer and Approved Valuer for many banks. Chairman and Member in Board of Studies of Civil Engineering branch. Question paper setter and Valuer for UG and PG Courses of Civil Engineering in number of Universities. Life Fellow in Institution of Engineers (India) and Institution of Valuers. Life member in number of Technical Societies and Educational bodies. Guided more than 400 students in UG projects and 150 students in PG projects. He is a reviewer for number of International Journals and published 102 International Journal Publications and presented more than 25 papers in International Conferences.



**M.Sivagnanam**, he completed his Diploma in Civil Engineering in Tamilnadu Government Polytechnic at Madurai. He was working as a Overseer in Rural Development and Assistant Engineer in the Rural Development Department. He also completed his B.E., Degree in the branch of Civil Engineering in Vinayaka Mission University. Currently he is doing his M.E.Degree in the branch of Environmental Engineering in the division of Civil Engineering in the Vinayaka Mission Kirupanada Variyar Engineering College,Salem. Now, he is working as District Engineer (RMSA) in Educaion Department of Central Government Scheme in Virudhunagar District of Tamilnadu