

Mapping & Analyzing Water Resources In Salem Using GIS and Remote Sensing

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ABSTRACT

The land use and land cover dynamics of water resources in and around Salem city is characterized and studied by Geo Information system and Remote Sensing. The location of Salem according to Toposheet of Survey of India is 11.669437° N and 78. 140865° E at the elevation of 278m and area of 5222 Km². Accompanying with population, development of manufacturing industries, large and small cottage industries increases humans dwell on such places to uplift their standard of life lead to land use /land cover. To map boundary of Salem city/ block of Salem district toposheets from municipal office is used. The Landsat satellite imagery (MCC) comprised of TM and ETM bands False Colour Composite (FCC) images are taken from Google earth for the study years. TM and ETM+ are the spectral bands of a satellite image TM has 6 bands the later has 7 bands, based on these bands we get a better resolution (in meters). The software used to analyze and process satellite image is ArcGIS, this project carried out by using Arc GIS 10.3 version. Now a day's because of urban sprawl and land use/land cover there is drastic reduction in water resources which can lead to water scarcity, the major environmental threat in present and future. This project brings out the extent of analyzing land use/land cover and water resources in the year 1973 and 2014 and forecasting results help us to prevent urban sprawl in water areas.

Key words: Arc GIS, Geo Information System, Landsat (MSS) imagery, Land use/land cover, Remote Sensing, Toposheet.

I. INTRODUCTION

The process of urbanization is a universal process that taking place all over the country, where the humans dwell. One of the main reasons for urbanization is population growth. It is noticed that the population of India in the year 1990 is 873,785,000 and in the year of 2010 it is increased as 1,224,614,000. Regions with good water resources, job opportunities and famous tourist spots getting urbanized faster than other regions. According to the census of India 2001, 25.73% of the population live in the urban Centre's, while it is projected that in 2016 about 33% would be living in the urban Centre's (et.al, S.Tamilenth, R.Baskaran, 2011 Geomatic Based Urban Sprawl Detection Of Salem City, India). Similarly in Raichpur city, Karnataka the built up area has increased from 1.41% in 1973 to 8.51 in 2010 (et.al R.Basawaraja, K.B. Chari, S.Rmise And S.B Chetti, 2011 Vol4(8), Analysis Of The Impact If Urban Sprawl In Altering The Land Use Land Cover Pattern Of Raichpur City, India Using Geo Spatial Technologies). Along with urban sprawl a fundamental parameter describing surface of the earth is land. Land use and land cover have its impact on environmental and landscape attributes including quality of water, land, soil resources, climate and vegetation. These environmental problems are often related to land use land cover changes. The importance of land as a key and fine resource for most human activities including agriculture, industry, forestry, energy production, settlement, water catchment and storage (et.al, T.Subramani, V.Vishnumanoj, 2014, Land Use And Land Change Detection And Urban Sprawl Analysis Of Panamarathupatti Lake, Salem). Due to burgeoning population and concentrated developmental activities, most of Tier I cities have exceeded their carrying capacities, which is evident from poor assimilative capacity (higher levels of pollutants in land, water and air), supportive capacity (lack of appropriate infrastructure, traffic bottlenecks) and lack of basic amenities (treated water supply, electricity and sanitation facilities. (et.al, T.V Ramachandra, Bharath H. Aithal, 2013 Urbanization And Sprawl In The Tier II City Metrics, Dynamics And Modeling Using Spatio Temporal Data). As a result of population explosion and land use, the total area of water bodies reduced comparatively with previous years all over India. Whenever there is shrinkage in water resources, those places become urbanized for people facilities. Because of improper planning and unplanned systems land use land cover leads to environmental problems such as flood, landslides etc. The system of GIS, remote sensing and data management systems has helped in modeling quantifying monitoring and predicting the key feature of sprawl and water resources.

Geographical information system (GIS) and remote sensing are well established and powerful information technologies to derive accurate information's on the spatial distributions of land use and land cover. These tools are cost effective than other tools to study and analyze such global parameters. Recent improvements in satellite image quality made it possible to perform image analysis much better than past. Landsat data are most widely used for studying the Land use and Land cover changes. K. C. Seto, C. E. Woodcock, C. Song, X. Huang, J. Lu and R. K. Kaufmann, have monitored the land-use change in the Pearl River Delta using Landsat. Satellite images are in the form of bands we can get two types of satellite images based on number of bands one is TM and the other is ETM. TM images have 7 bands whereas ETM images hold 8bands. False color composite (FCC) changes are made up to get a detailed analyze of the image (H.S Sudhira, T.V.Ramachandra, K.S.Jagadish, 2004, Urban Sprawl Metrics, Dynamics and Modeling Using GIS).

The aim of this study is to analyze and monitor water resources in and around Salem city using Landsat Multi-spectral Scanner (MSS) and Enhanced Thematic Mapper Plus (ETM+) data acquired on the years 1974 and 2014. Information on urban sprawl, land use and land cover change study is very useful to local government and urban planners for the betterment of future plans to improve the area of water bodies in salem city.

The main objective of this paper is

Analyze and monitor water resources in and around Salem as a change detection of land use and land cover. To find the water shrinkage by comparing the satellite images of year 1973 and 2014.

II. STUDY AREA

The study area Salem city is situated in Salem district, Tamilnadu, India. It comes under semi arrived region. Salem is the sixth largest city in India by population and covers 39 Sq. mi. This is surrounded by hills on all the sides. The Nagaramalai to the north, the Jarugumalai to the south, theKanjamalai to the west, and the Godumalai to the east. Salem is divided by the river Thirumanimuthar in the main division.

The following maps give the location of our study area.

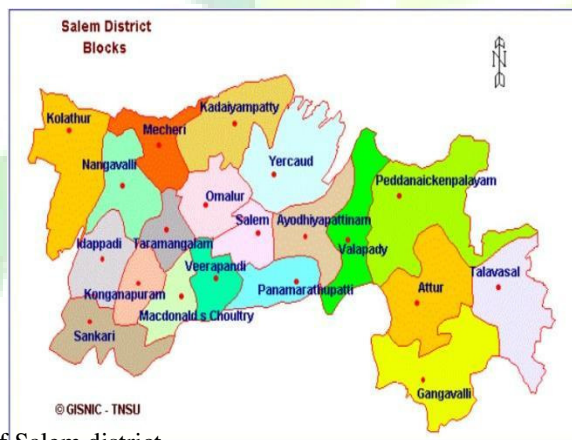


Fig1: Blocks of Salem district.

Salem district comprises of Salem corporation, 4 municipalities (Mettur, Attur, Narasingapuram, Idapadi), 20 blocks, 33 Town panchayats, 20 panchayat unions having 385 village panchayat comprising 5744 habitations.

A.BASE MAP

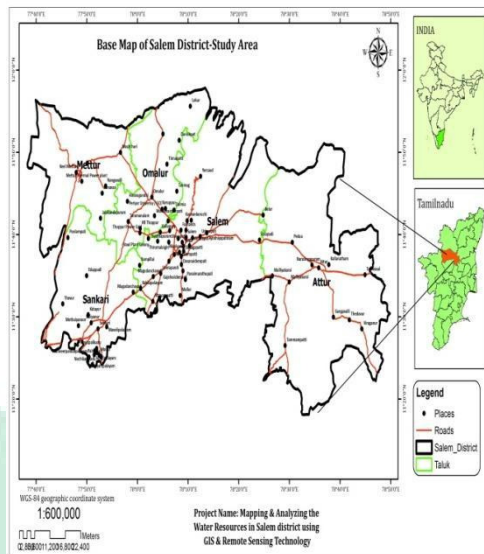


Fig 2: Base map of Salem city map that denotes roads, taluks and place.

III.METHODOLOGY

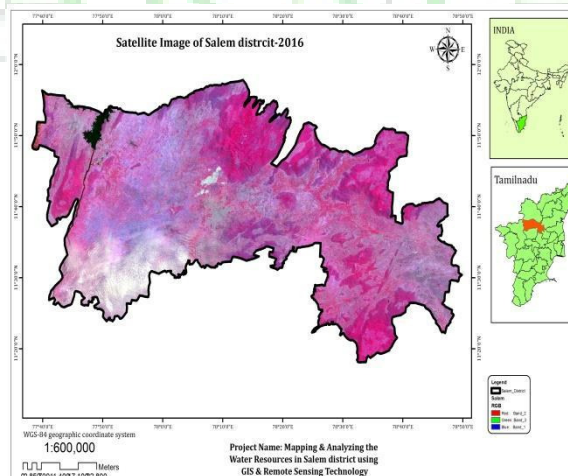
A. DATA COLLECTION

Images: Landsat satellite images.

Year: 1973 and 2014.

Software: Arc GIS 10.3.

Landsat MSS and Landsat ETM images are downloaded from USGS earth resource observation systems data Centre and Landsat MSS images are provided by commercial data providers. In this study we downloaded map of the years 1974 and 2014 to analyze. These images are free sources and anyone can use it. Both primary and secondary data's are collected for this study. Primary data includes information from toposheets provided by Survey of India. Landsat MSS, Landsat ETM, Multi spectrum satellite images from Indian Remote Sensing Satellite. Secondary data comprises of population growth, the corporation map of this region was obtained from Town and Country Planning, Salem, Tamilnadu, India. Suitable False Colour Composite are given for convenience of our study.



Map1: satellite image of salem(FCC)

Thematic Mapper (TM)	Landsat 4-5	Wavelength (micrometers)	Resolution (meters)
Bands	Band 1	0.45-0.52	30
	Band 2	0.52-0.60	30
	Band 3	0.63-0.69	30
	Band 4	0.76-0.90	30
	Band 5	1.55-1.75	30
	Band 6	10.40-12.50	120*(30)
	Band 7	2.08-2.35	30

Table 1: TM wavelength and resolution.

* TM Band 6 was acquired at 120-meter resolution, but products are resampled to 30-meter pixels. A

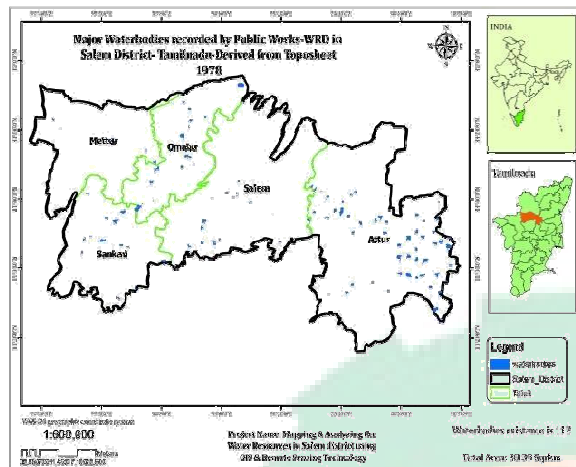
Landsat Enhanced Thematic Mapper Plus (ETM+) image has 8 spectral bands with a resolution of 30 meters for bands 1-7. the resolution for band 8 is 15 meters. Band 8 collects both low and high resolution for all scenes.

Enhanced Thematic Mapper Plus (ETM +)	Landsat 7	Wavelength (micrometers)	Resolution (meters)
Bands	Band 1	0.45-0.52	30
	Band 2	0.52-0.60	30
	Band 3	0.63-0.69	30
	Band 4	0.77-0.90	30
	Band 5	1.55-1.75	30
	Band 6	10.40-12.50	60 * (30)
	Band 7	2.09-2.35	30
	Band 8	.52-.90	15

Table 2: ETM wavelength and resolution.

IV.RESULTS AND DISCUSSION

The classified images obtained after image preprocessing and supervised classification which are showing water resources of the Salem city are given in the following figures. These images also provide the information about the land use pattern of the study area.



Map 2: Major water bodies in Salem

This map gives the detail about various water bodies in 5 different taluks and it is seen that Attur is the taluk comprised of many water resources.

B. BUILDUP AREAS

S.no	Class	
1	Basins	Cauvery and ponnaiar river basins
2	Sub basins	Sarabanga, Tirumanimuttar, Gomukhi, ayyar, Vasisa and Suveda.
3	Drainage	Tributaries of Cauvery and velar river
4	Total no.of sources	387(Salem city)
5	Deep bore well	308(Salem city)
6	Shallow bore well	3(Salem city)
7	Sanitary open well	76(Salem city)

Table 4: Water resource in salem

C.BASINS AND SUB BASINS OF SALEM

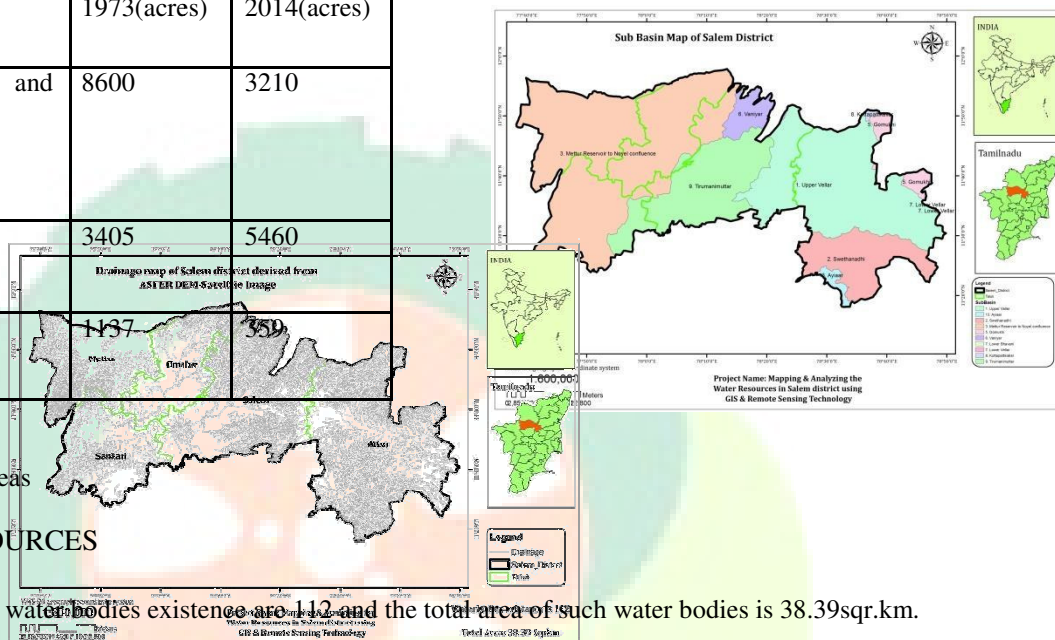
According to census of India (1971, 1981, and 1991), the population growth in Salem area grew by about 54%. From 1973 to 1999 the built up is about 146 % (et.al S.Tamilenthi, R.Baskaran, 2011 Geomatic Based Urban Sprawl Detection of Salem City, India).

s.no	class	1973(acres)	2014(acres)
1	Crop plantation and	8600	3210
2	urban	3405	5460
3	Fallow land	1137	350

Table 3: Buildup areas

C. WATER RESOURCES

In Salem district the water bodies existence are 142 and the total area of such water bodies is 38.39sqr.km.



Map 3: sub basin of Salem district

In Salem district, Mettur, Attur, Sankari, Omalur and Salem are the main taluks. The above map represent the sub basins present in such taluks. Mettur reservoir comes under the taluks of Mettur, Omalur and sankari. Tirumanimuttar, vanniyaar and a part of upper velar are flows in Salem taluk. The other basins such as gomukhi, Swethanadhi, Lower velar, Ayiaar are in Atturtaluk.

D. DRAINAGE SYSTEM

Mapping drainage system is important to know about water supplied areas

Map 3: Drainage system of Salem district

In the above map, green colour boundaries denote the areas of taluks in salem district. The grey coloured lines represent the drainage system of salem district. As because the population increases,land use and land cover increased . As a result of these effects the drainage usa

IV.CONCLUSION

The study was carried out in Salem Corporation using the techniques of GIS and Remote Sensing for the detection of water resources. The land use/land cover is seen as one of the major threats to sustainable development. The rapid increase of population leads to gradual decrease of all natural resources (water areas, agricultural lands, forest areas etc.,). Here the results give us the effective mapping and monitoring of water areas in Salem city. The spatial data along with the attribute data of Salem area are used for statistical analyzing and forecasting.

Furthermore, it shows the change in land cover patterns and need for monitoring such areas for future land development. With the framework of this study, for the detection of possible land covered water areas in Salem city was analyzed. The study attempts to map and monitoring such sprawls change in land use and land cover change for 1973 and 2014 by using this study forecasting the same for further upcoming years can be done.
ge or supply increased and increased in number

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