LAND USE CHANGE ANALYSIS USING REMOTE SENSING TECHNIQUE IN SHOLINGANALLUR, CHENNAI, INDIA

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ABSTRACT
Mapping the Land Use (LU) change detection of a place using the remote sensing and GIS technique is cost effective and to obtain the clear data for analysis place several years for LU. This research study about the LU change in Sholinganallur located in IT corridor south of Chennai, India. Due to the rapid development of Information Technology increase the economy, population and infrastructure of Sholinganallur also increase real estate activities and construction activities for the increasing population but it leads to shrunken of many water bodies and vegetation in the Sholinganallur. This project analyzed the LU over the period of 2005 to 2015. LANDSAT 7 ETM+, LANDSAT 8 OLI satellite imagery is processed using the ENVI 5.3 and mapped the classified image using the ARC MAP. The result of the project shows that rapid growth in urban (built-up area) from 24.91 % to 61.1% during the year 2005 to 2015. This research is to analysis the Land use change of the place and to ensure that development in sustainable manner without affecting the environment for the future planning of this place.

Key words: Land Use (LU), Change Detection, Remote Sensing, GIS, ENVI, ARC MAP.

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1. INTRODUCTION
Change is occurring everywhere in the earth over these years. By detecting the change in the place can be used to study about the effect on the environment cause by that change. The land use refers to the change created in the place by various human activities and land cover is the change by the natural phenomena. But over the years land use is more impact on the environment then the land cover. Remote techniques made the analysis of land use easier than other methods and also time saver then we also get the satellite data for various year from
USGS website supervised algorithm can be implemented if we know about place and ground truth data needed and unsupervised classification can be used if we lack of knowledge about the place. Population increasing is the one of the main reason for increasing of land use so that many agricultural and water areas has been changed to build areas.

The land use land cover of both areas was unchanged before the construction while settlement alone covered most part of the area. However, during the post - dam era, land use /land cover classes changed but with settlement still remaining the largest. (Adeniyi et al. 1999) [1]. In their comparison of land use land cover change detection methods, made use of 5 methods viz; traditional post – classification cross tabulation, cross correlation analysis, neural networks, knowledge – based expert systems, and image segmentation and object – oriented classification. A combination of direct T1 and T2 change detection as well as post classification 10 analysis was employed. Nine land use land cover classes were selected for analysis (Daniel. 2002) [4]. The coal mining work impact on land use/land cover using remote sensing and GIS technique. (Sarma et al. 2005) [14]. The data source for satellite data were USGS and image processed using ERDAS imagine and resultant map present using ARCGIS then the aerial image for ground truth data this study found that forest land was converted to agricultural land and increasing of built up area and LULC change mostly in coastal areas. (Selcuk Reis 2008) [15]. Land use change due to mining The study revealed that mining in the area increased in land coverage from 1986 to 2006 with decrease in agricultural land use. Settlements increased due to a rural – urban migration. (John Edward et al. 2009) [6]. To analyze the variations in the thermal environment that exists throughout the city due to different land cover conditions. This study analyses the temperature differences in the city the various land cover types such as dense vegetated areas, barren land and industrial areas, dense built up spaces, water bodies etc. contributes to the variation in temperatures leading to the formation of urban micro heat islands. Urban planners, designers, architects need to considering the Urban climate while designing and planning city (Lilly Rose Amirtham et al. 2009) [8]. The study highlights the need for a scientific management plan for the sustainability of the river basin, keeping in view the recent climatic anomalies and hydrological conditions of the basin. The study was carried out through Remote Sensing and GIS approach using SOI toposheets, Landsat imagery of 2000 andIRS-1D-LISS-III 2010. The land use/land cover classification was performed based on the SOI toposheets and Satellite imageries. GIS software is used to prepare the thematic maps and ground observations were also performed to check the accuracy of the classification. (Nikhil Raj.P. P et al. 2010) [11]. Identifying hotspots of land cover changes using multi temporal satellite data and also studying relationship between human pressure on land use/landcover and its impacts in the vital Urban habitats. (Manomani.R et al. 2010)[9]. the changes of lakes to build up areas using the satellite image and topographic maps due to the increase of population and shortage land is the main reason behind change of lake to built area. (Jing wu et al. 2011) [7]. Adopt supervised classification maximum likelihood algorithm for better classification the found that built area has been increased and other area were decreased and expansion of town (Manish Kumar.B et al. 2013)[10]. The Mapping of land use/land cover classes is important task to conserve natural resources and to put suitable management practices sand dunes surround the vegetated land, which in turn will lead to the loss of some of the productive lands through sand encroachment. Necessitates the adoption of suitable management practices to retard and, if possible, to stop sand encroachment. (Dafalla M.S et al. 2013) [3]. the multi temporal satellite image to detect the change in Landuse/Landcover monitored the data source were Global Land Cover Facility(GCLF) and earth explorer then they adopt supervised classification maximum likelihood in ERDAS 9.3 software and they found that vegetation and built area has been increased and agriculture, water area has been decreased. (Rawat.J.S. et al .2015) [13]. agricultural, settlement increased and vegetation, water cover reduced it is serious
threat to watershed due to improper management and they conclude that if no proper management watershed will be lost due to agriculture expansion. (Amna Butt et al. 2015) [2]. Urban growth is main reason for many environments Impacts like decreased air quality, increased local temperature. They found that built area is increased about 30% and subsequent agriculture land decreased they monitored the urbanization for future planning for sustainable development of city. (Ibrahim Rizk Hegazy et al. 2015) [5]. The evaluation of watersheds and development of a management strategy require accurate measurement of the past and present land cover/land use parameters as changes observed in these parameters determine the hydrological and ecological processes taking place in a watershed. (Nambi Harish et al. 2016) [12].

1.1. Need to Study
In general, the term ‘kazhuveli’ refers to marsh land meaning grass with moisture. In particular it is a place where the sea water (salt water) and river water (good water) merge with each other. This is a vital resource and it has legal implication too. One’s attention is drawn to the international RAMSAR Convention which tried to protect the marsh land resource in every country. India is one of the signatories to the treaty that was drafted in 1971. Besides this, India brought forth National Wetland Conservation Programme during 1985-86 under which 94 wetlands were identified for special protection. The Tamil Nadu Government introduced a legislation giving special protection only in 2007. In spite of legal enactments and protection to the identified wetlands, all such natural resources have been mercilessly exploited and destroyed during the 20 years gap between Central Govt announcement and TN govt announcement.

Once upon a time, these marsh lands were spread throughout the area from Pallikaranai to Muttukadu. However, over a period of time, these marsh lands have since been exploited and almost completely damaged right from IT companies to ordinary petty shops including houses built in this area. In fact, the factor that was responsible for the complete deluge of Velachery during 2015 floods was due to the fact all the wetlands in the area of Pallikaranai had been cut off mercilessly.

Earlier, Pallikaranai marsh land was occupying a total area of 5000 hectares, receiving the waters from the branches of Adyar and sending it back to the sea after retaining its required portion. The pity is that it is now spread hardly over 500 hectares. In addition to this, this area is the preferred resort of both local and overseas birds from time to time. Before 2007 Tamil Nadu Government had converted this as a protected land. However, right from 1995, Pallikaranai happened to be the place of mass garbage dumping with easy access to all kinds of contaminated waters to be mixed in this protected wetland. Thereafter, the real face of this protected site started becoming a solid example of utter contamination and pollution.

The entire Pallikaranai area is now swamped with high degree of contamination and toxic elements and naturally the so called precious wetland has become as dirty as one could ever imagine. The area which is behind this site is largely under encroachment up to Thoraipakkam, OMR Road. With contamination of all sorts, the entire area has become highly obnoxious to say the least. In effect, this accumulated dirty water gets directed to Buckingham canal. Automatically, this contamination spreads throughout the Buckingham canal and gets stretched to Muttukadu which is very sad. (VIKATAN Published 27/07/2017 https://www.vikatan.com/news/english/96856-elcot-destroying-sholinganallur-marsh-land.html)
1.2 Aim
The aim of the study is to produce a Land Use map of Sholinganallur, Chennai, India at different periods in order to detect the Land Use change in urban, vegetation, water body, soil fill, marshy land.

1.2. Study Area
Sholinganallur is a Residential Locality of Chennai Metropolitan city located on latitude 12°54'3.56"N and longitude 80°13'40.55"E the IT corridor south of Chennai in the Indian state of Tamil Nadu. The rapid growth of Sholinganallur's economy, population and infrastructure can be attributed to Information Technology Business Parks and dedicated Special Economic Zones (SEZ). Sholinganallur is surrounded by other IT based suburbs such as Siruseri, Perungudi and Taramani. Tamil Nadu Government's TIDCO is building a Financial City in Sholinganallur to house global financial corporations. Sholinganallur is the biggest assembly constituency in Tamil Nadu in terms of voters. Sholinganallur was annexed in to Chennai Corporation in 2011, and it is the last (200th) ward of Chennai city, administered as a part of Chennai corporation.
2. METHODOLOGY

This study is following the methodology as shown in figure 2.

![Methodology flow chart]

**Figure 2** Methodology flow chart

### 2.1. Data acquisition

Landsat satellite images of Sholinganallur, Chennai, India were acquired for the year from 2005 to 2015 from United States Geological Survey (USGS). Landsat 7 ETM+, Landsat 8 OLI images were used.

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Data Type</th>
<th>Year</th>
<th>Spatial Resolution</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LANDSAT 7 ETM+</td>
<td>2005 TO 2012</td>
<td>30 m</td>
<td>USGS</td>
</tr>
<tr>
<td>2</td>
<td>LANDSAT 8 OLI</td>
<td>2013 TO 2015</td>
<td>30 m</td>
<td>USGS</td>
</tr>
</tbody>
</table>

### 2.2. PREPROCESSING

Image rectification and restoration procedures are often termed as ‘Preprocessing’. Preprocessing functions involve those operations that are normally required prior to the main data analysis and extraction of information and are generally grouped as radiometric or geometric corrections.

**Radiometric corrections** include correcting the data for sensor irregularities and unwanted sensor or atmospheric noise and converting the data so they accurately represent the reflected or emitted radiation measured by the sensor.
Geometric corrections include correcting for geometric distortions due to sensor-Earth geometry variations, and conversion of the data to real world coordinates (e.g. latitude and longitude) on the Earth's surface.

Radiometric calibration and FLAASH (Fast Line of site Atmospheric Analysis of Hypercubes) FLAASH is a first principle atmospheric correction tool that corrects wavelength in the visible through near infrared and shortwave infrared up to 3 micrometers then we apply band math equation.

**BANDMATH EQUATION**

The atmospherically corrected data has some values that are outside a reasonable range because some pixels are not modelled well. Some reflectance values (divided by 10,000) are sometimes negative or greater than 1 in the corrected results. Band Math (BM) equation to be apply flaash.

\[(b1 \leq 0) \times 0 + (b1 \geq 10000) \times 1 + (b1 \gt 0 \text{ and } b1 \lt 10000) \times \text{float}(b1)/10000\]

2.3. IMAGE ENHANCEMENT

Image enhancement is solely to improve the appearance of the imagery to assist in visual interpretation and analysis. Image Enhancement alters the visual impact that the image has on the interpreter in a fashion that improves the information content. After resize the corrected data using shape file then stretch the data

![Figure 3 Data after stretch](image)

3.6. IMAGE TRANSFORMATION

Image transformations are operations similar in concept to those for image enhancement. However, unlike image enhancement operations which are normally applied only to a single channel of data at a time, image transformations usually involve combined processing of data from multiple spectral bands. Arithmetic operations (i.e. subtraction, addition, multiplication, division) are performed to combine and transform the original bands into "new" images which better display or highlight certain features in the scene. Band 321 (RGB) True color
composite have been applied to detect the feature by naked eye. MNF (Minimum Noise Fraction) is to segregate noise in the data.

3.7. IMAGE CLASSIFICATION
Image classification and analysis operations are used to digitally identify and classify pixels in the data. Classification is usually performed on multi-channel data sets and this process assigns each pixel in an image to a particular class or theme based on statistical characteristics of the pixel brightness values. There are a variety of approaches taken to perform digital classification. The two generic approaches which are used most often, namely supervised and unsupervised classification.

Supervised classification maximum likelihood is used for LU classification area is divided into urban, vegetation, water, soil fill, marshy land is shown in the classified image and that mapped using Arc map for year 2005 to 2015.

4 RESULT AND DISCUSSION
The static land use distribution for the study year derived from the map are presented

<table>
<thead>
<tr>
<th>LandUse Categories</th>
<th>2005</th>
<th>2010</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area (Km²)</td>
<td>Area (%)</td>
<td>Area (Km²)</td>
</tr>
<tr>
<td>Urban</td>
<td>29.02</td>
<td>24.91</td>
<td>58.25</td>
</tr>
<tr>
<td>Vegetation</td>
<td>21.72</td>
<td>18.65</td>
<td>9.33</td>
</tr>
<tr>
<td>Waterbody</td>
<td>20.35</td>
<td>17.47</td>
<td>11.07</td>
</tr>
<tr>
<td>Soil fill</td>
<td>29.85</td>
<td>25.63</td>
<td>31.82</td>
</tr>
<tr>
<td>Marshy land</td>
<td>15.54</td>
<td>13.34</td>
<td>6.01</td>
</tr>
</tbody>
</table>
4.1. CHANGE DETECTION

From these Land Use map, it clearly shown that there is rapid growth in urban area from 24.91% to 61.1% and there is depletion in the other classes that vegetation decreases from 18.65% to 9.64 %, water body decrease from 17.47% to 6.11%, Soil fill decreases from 25.63% to 19.15%, marshy land 13.34 % to 4%. From that it shows that marshy land had been decreased even though marshy land protection has been implemented and water body, vegetation, soil fill decreased due to construction activities in and around the town causes this change and in 2015 Chennai flood Sholinganallur affected much due to that increased built up area by destroying many water path and water drainage area.
5 CONCLUSION

Sholinganallur, Chennai, India is experiencing a rapid urbanization, the urban sprawl is seen as one of the potential threats to sustainable development. This study attempted to identity such urban sprawls change from 2005 to 2015. Remote sensing has the capability of monitoring such changes. In this work we have taken the Landsat 7 ETM+, Landsat 8 OLI images of Sholinganallur collected from USGS website from 2005 to 2015 study period. The land use map of study area developed by Supervised classification of the images. Five land use classes have been identified as Urban (built up), water body, vegetation, soil fill, marshy land. Change detection shows that urban area increases from 24.91% to 61.1% and there is depletion in the other classes that vegetation decreases from 18.65% to 9.64%, water body decrease from 17.47% to 6.11%, Soil fill decreases from 25.63% to 19.15%, marshy land 13.34 % to 4% during the study period 2005 to 2015. This information assists in monitoring the dynamics of land use resulting out of changing demands of increasing population.

REFERENCE


Selcuk Reis (2008)” Analysing Land use/Landcover change using Remote sensing & GIS in Rize, North east Turkey”.

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