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An analysis on changing dynamics of Land use Land cover in Tiruchendur area, Tuticorin, Tamilnadu

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Abstract- The study of land use land cover change dynamics is of greater importance to know about the global climate change and for evaluating and conserving the resources of the earth. It also defines the activities of humans and its impact on the environment. The estimation of LU/LC changes between 2000 and 2010 is carried out in Tiruchendur using remote sensing and GIS techniques. The change detection analysis is done by 30 m resolutions of cloud-free Landsat 8 and Landsat 7 ETM data acquired during the years 2000 and 2010. The change dynamics displays major classification of land use features such as water bodies, vegetation, settlements, cropland, barren and saltpans based on the supervised classification of a maximum likelihood algorithm. The images which are depicted shows an optimistic change on settlements (+215.38 %), barren (+5.15 %) and saltpan (+48.05 %) and negative results in croplands (-38.24 %), vegetation (-7 %) and waterbodies (-34.87 %) respectively. The present study revealed that urbanization and industrial production (salt) is highly deployed in Tiruchendur region.

Keywords: Land use /land cover (LU/LC); Tiruchendur; supervised classification.

1. INTRODUCTION

Land covers refer to the surface cover of land such as forest region, water bodies, bare lands whereas land use indicates the usage of land by people such as urban infrastructure, agriculture etc. The pattern of land use/ cover of an area is a result of environmental and anthropogenic factors and exertion by the man in space and time (J.S. Rawat and Manish Kumar., 2015). The usage of land affects the landcover pattern and changes in land cover inflicts land use. The study of LULC is very essential to predict the global level changes. It also includes climate-driven land cover modification, population growth, technological change, land transformations. In recent decades, conversion of grasslands, forest areas into cropland and urban developments have increased catastrophically in the tropical regions. (Houghton 1994; Williams 1994). This has spurred concerns about noticing the pattern of LUCC which plays a major role, in changes occurring in biological diversity. These activities have involved in increasing the emissions of greenhouse gases for about 20-75% in the atmosphere (Penner., 1994). With the invent of remote sensing techniques such as satellite and aerial imagery, the changes in land cover can be detected but not land use. i.e. the data collected using remote sensing techniques relates to the land cover and the information inferred from the data with an addition to prior knowledge refers to land use.To detect the change in LULC, multitemporal analysis of satellite imagery is an effective tool due to the high correlation between spectral changes in the imagery and landcover variation. GIS provides opportunities to get detailed information by adding multiple layers of spatial information. The outcome of change detection analysis can provide more information when combining satellite imagery with other spatial layers such as political boundaries, topography etc. Various techniques have been used for the preparation of LUCC maps using high altitude, air photo /imagery. Different classifications like supervised, unsupervised techniques are also used. Some standardized land use classification map like 1962 Khan and Islam are used for classification of LULC. Rasterization process is also followed for LUCC change analysis.

In India, land use land cover change studies are taken by various researchers, especially using remote sensing data. For example, a study carried out by Amin et.al., 2012 of Srinagar city in Kashmir valley has shown significant changes from 1990-2007 indicating the LUCC impacts as loss of forest area, bare lands etc. Another study carried out by Pandey et al.,2012 presented the geospatial approach to improving the suitable sites for municipal waste disposal activities for the growth of urban environment.

The objective of the present study is to analyze the land use land cover changes for the years 2000 to 2010 at Tiruchendur region using remote sensing and GIS techniques.

2. STUDY AREA:

Tiruchendur taluk lies along the shore of Bay of Bengal and is at the south-east coast of India, in the Thoothukudi district of Tamil Nadu between 8°26`56`` N to 8°34`51.6`` N latitudes and 78°5`20.4`` E to 78°8`6`` E longitudes. Tiruchendur region is a taluk of the "Pearl city" Thoothukudi. It consists of many coastal villages, beaches, etc. It is characterized by a tropical climate with intense hot in summer between May and August and gentle winter in between December and February. It is elevated 3 m (10 ft) above from sea level. The suburban villages around the town consists of arid, red soil forests that are densely populated with palm trees, cashew plantation and other crops typical of the region. The maximum and minimum temperature experienced by the region is about 35°C on a day to 27°C at night. The average annual rainfall experienced is 280 nm. This region experiences the lowest chance of significant precipitation as 0.1 inches during the month of January, February, and March and it is most likely to rain or snow in early June. It gives maximum rainfall during the Northeast monsoon (444 nm) than that of Southwest monsoon (117 nm). It is highly humid in the coastal sectors. According to the census of India's report, the population of Tiruchendur is about 32,171 at 2011. Tiruchendur taluk has a remarkable conversion of vegetative landforms into settlements and saltpans.

3. MATERIALS AND METHODS:

LU/LC change analysis is a useful operation of accessing and monitoring land dynamic between four points of time. These vertical operations can be done by 30m resolution of cloud-free Landsat 8 and Landsat 7 ETM + data acquired at the duration of 2000 and 2010. Past 16 years of dynamic change are categorized as the major land using physical features settlement, saltpan, cropland, vegetation, barren and water bodies The GIS processed Landsat image provides in detail about land cover changes.

3.1 Pre-classification

The area to be studied of varying durations (2000 and 2010) of Landsat images with a projection of WGS 1984 datum can be obtained (downloaded) from USGS – free access of earth explorer website. All the data are attempted to the atmosphere and radiometrically corrected and re-projected into UTM 44 northern hemisphere, to visualize the True Colour Composite (TCC) of RGB in the band combined by mosaicking (The products based on georeferenced).

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The georeferenced vector file Tuticorin coastal boundary is obtained from the final subset of product performed.

3.2 Classification analysis

LU/LC classification by human activities was developed under the supervised classification of the widely used Maximum Likelihood Classification (MLC) (Shalby and Tateishi,2007; Otukei, et al., 2010). Commonly, supervised classification is categorized by several better accurate methods, such as parallelepiped, minimum distance, minimum likelihood classifications (Lillisand, et al; 2004) and the classification process is performed as possible homogeneous and the sample class of signatures is characterized (Land grebe, 2003) maximum likelihood classification (MLC) is calculated from a discriminate function of each pixel on the image (Richards, 1999). The FCC'S reflectance of the settlement, saltpan, cropland, vegetation, barren and water body signature is generated through the Region of Interest (ROI) tools based on visual digitization (He, et al; 2011). The land use/cover of high resolution is obtained using maximum likelihood classification with the reference of verified ROI signatures.

4. RESULT AND DISCUSSION

The study is carried out to determine the LU/LC changes all through 2000 to 2010 of Tiruchendur block which reveals the development and change in the extension of anthropogenic exploitation in the region. The comparison of LU/LC map change analysis of two different periods is based on the existence of cell and area in square kilometres with the percentage (figure 1&2).

4.1 Analysis of land use land covers change

The development of human settlements in the rural and urban region has raised from 25.036673 km^2to87.973109 km^2 and the difference is 62.936436 km^2 which are a drastic rise. The occupancy of habitation space is transformed from water bodies, vegetation and cropland during the period of study. The extension of salt pans is increased from 15.020108 km^2 to 22.238674km^2 with a difference of 7.218566km^2. This shows the development of salt production of the major industrial factor of the coastal region. The area of land for the expansion of saltpans has been acquired from cropland to water body.

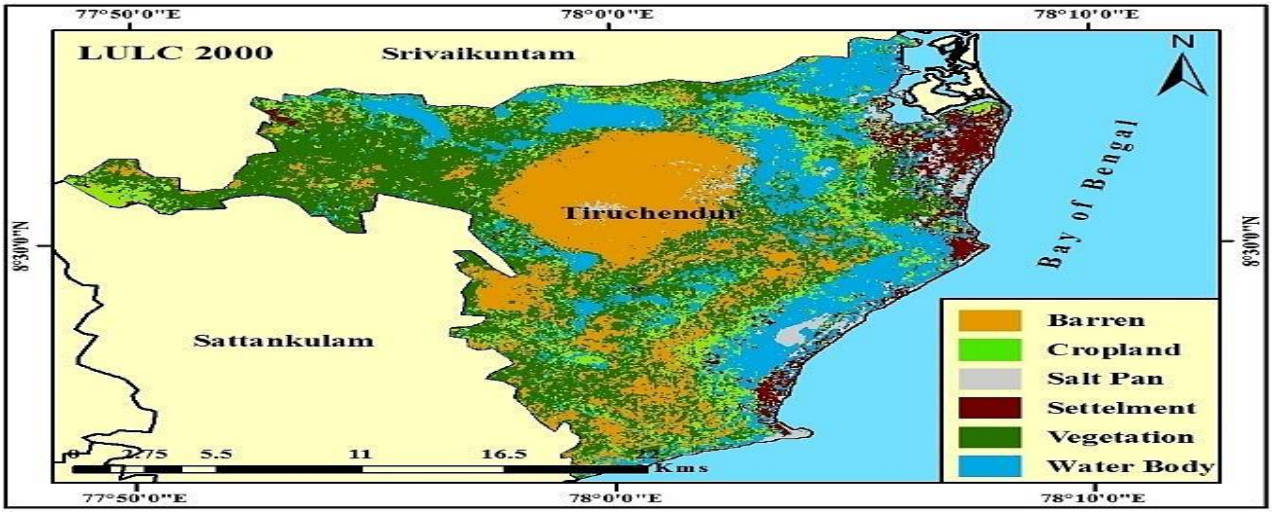

Fig.1 Land use land cover classification map of Tiruchendur in 2000

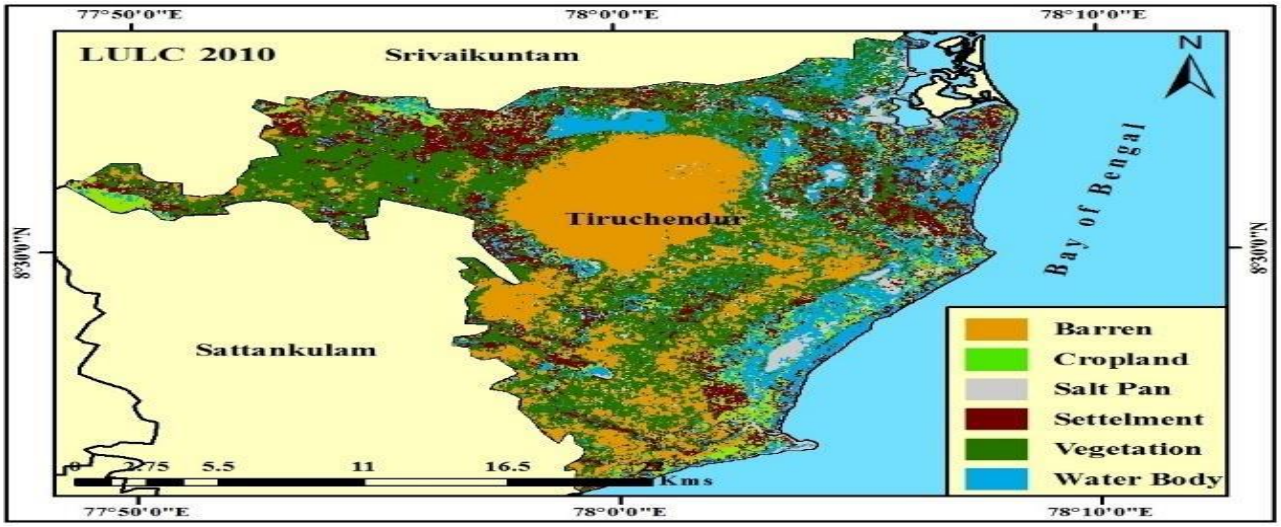

Fig.2 Land use land cover classification map of Tiruchendur in 2010

The deterioration of cropland from 58.38753km^2 to 36.058017km^2 due to vegetation and human encroachment. Even then the vegetation even has also reduced considerably from 181.980012 km^2 to 169.254401km^2. This is also due to the human settlement. This indicates the change of environment due to anthropologic activities. The increase in the region of Barren land from 121.417957km^2 to 127.677057km^2 shows the need for development. The water body region has shrunk from 118.57757km^2 to 77.218502km^2. However, the dynamic change detection is due to Barren and human settlement.

4.2 Net loss and gain

The overall categories which give the net loss and gain would help to determine the dominance of ecological changes in Tiruchendur regions are represented in the figure. From those, we can find there is a massive change in Land use/ cover. The Barren land which is gained by 6.25907 km^2 shows the regular decrease of human habitat which has loss 121.417987km^2 and gain of 127.677057 km^2 (5.15 %). In cropland zone there is a gain of 36.058017 km^2 and loss of 58.38753 km^2, gives the negative outcome(-38.24 %), this is due to the increase in the uncultivated land by human rate due to settlements. In the salt pan, the net loss and gains are 15.020108 km^2 and 22.238574 km^2 (48.059 %), gives the change at the rate of 7.218566 km^2, due to the increase of the rate of seashore activities. The settlements have gained 87.973109 km^2 and loss of about 25.036673 km^2 which results in the domination of massive 62.46436 km^2 (215.37 %) of land areas including croplands, which is due to regular activities of ecology. Simultaneously, there is a steady decrease of

vegetation land which has loss and gain of 181.980012 km^2 and 169.254401 km^2 (-6.992861 %), which gives the difference of 12.725611 km^2, this is due to the eradication of vegetative land by human activities. The water body cover is the study region shows a loss of 118.57751 km^2 and a gain of 77.218562 km^2 (-34.8792 %); The negative result is due to the domination of the settlement region. The issues at Tiruchendur region is due to the massive settlement progress, saltpans and huge domination of people over vegetative landforms.

5. CONCLUSION

The objective of the present study was to study about the LU/LC change of Tiruchendur region of two different duration ie. 2000 and 2010. The Landsat images are collected and by using supervised classification of the human activities on the LU/LC classification was developed. Also, the land use features were classified as cropland, barren, vegetation, settlements, saltpan and water bodies based on maximum likelihood supervised classification.

Table 1. Change dynamics of different categories of LU/LC classification in square kilometres

Category	**2000**	**2010**
Barren	121.417987	127.677057
Cropland	58.38753	36.058017
Saltpan	15.020108	22.238674
Settlement	25.036673	87.973109
Vegetation	181.980012	169.254401
Water Body	118.57751	77.218562

The images which are classified are synchronized for change detection and net loss and gain of all classes. It is confirmed from the outcomes above, that the change detection of two different time periods reveals the significant dynamic and relocation of land uses. The speedy improvement of settlements saltpans and barren due to anthropogenic activities have ended with the fall in cropland, vegetation, and water bodies from 2000-2010. The overall gain category of positive concurrence is in settlements (+215.38 %), saltpans (+48.05 %), and barren(+5.15 %) but the net loss is in water bodies(-34.87 %), cropland(-38.24 %), and vegetation(-7 %). This study reveals that the steady fast growing anthropogenic activities and encroachment of croplands and urbanization has led to critical issues. Therefore, an appropriate land use practices and governing coastal environments would be implemented until the officials and people properly implements the land use policies and relevant laws. Hence the different factors indulged in spatial management of coastal area and the enactments associated to them within the dimension of comprehensive scientific land use devising, progression and protection which will make the deciding authorities to find the vulnerable regions of Tiruchendur coastal area to identify better possibilities to the present problem to conserve the life of human beings and assets from natural calamities.

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REFERENCES

[1] Chipman, W., Lillisand, M., Schmaltz, E., Leale, E., Nordheim, J., 2004.Mapping lake water clarity with Landsat images in Wisconsin, USA. Canadian Journal of Remote Sensing. Volume 30, Issue 1.

[2] Land grebe., D.A.,2003. Signal theory methods in multiplied Remote Sensing, New York: John Wiley publication.

[3] Richards., 1999. Remote Sensing Digital Image Analysis. Australian National University Res. School of Information Science, Canberra, Australia.

[4] He, K., Sun, J., Tang, X., 2011. Single Image Haze Removal Using Dark Channel Prior. The Chinese University of Hong Kong, Hong Kong. Volume 33, Issue 12.

[5] Rawat, J.S., Kumar, M., 2015.Monitoring land use/cover change using remote sensing and GIS techniques: A case study of Hawalbagh block, district Almora, Uttarakhand.The Egyptian Journal of Remote Sensing and Space Science. Volume 18, Issue 1, pp77-84.

[6] Penner, J.E., 1994.Atmospheric chemistry and air quality. In changes in land use and land cover: a global perspective. pp 175-210

[7] Houghton, R.A., 1994. Global Impact of Land-Cover Change, The Worldwide Extent of Land-Use change. Vol. 44, No. 5,pp 305-313

[8] Amin, A., Amin, A., Singh, S.K., 2012.Study of the urban land use dynamics in Srinagar city geospatial approach. Bull. Env. Sci. Res 1(2), pp18-24

[9] Pandey,P.C,Sharma,L.K,Nathawat,M.S,2012.Geospatial strategy for sustainable management of municipal solid waste for environment,Envi.Monit.Assess.184(4),pp 2419-2431

[10] Williams,M.1994.Forests and tree cover.In changes in Land Use and Land Cover:A Global Prespective.Pages 12-97

[11] Shalaby A and Tateishi, R 2007 Remote sensing and GIS for mapping and monitoring

land cover and land-use changes in the Northwestern coastal zone of Egypt Appl. Geography,pp28-41

[12] Otukei, J. & Blaschke, T. 2010. Land cover change assessment using decision trees, support vector machines and maximum likelihood classification algorithms. International *Journal of Applied Earth Observation and Geoinformation*, vol. 12, pp. S27-S31.