Land Use and Land cover for one Decade in Coimbatore Dist Using Historical and Recent High Resolution Satellite Data

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Abstract–The awareness of landuse / land cover assessment is very important to understanding natural resources, their utilization, conservation and management. In recent years remote sensing and Geographical Information System have gained importance as vital tools in the analysis of temporal data at the district and citylevel. The present study evaluates the effectiveness of high-resolution satellite data and computer aided GIS techniques in assessing landuse / land cover change detection for the period 1990 to 2000 within the study area, Coimbatore District. This paper describes assessment of the land use and land cover changes in the Coimbatore District for one decay. IRS IC images of 1990 and 2000 w ere analyzed using Erdas Imagine software and ArcGIS. A total of five broad landuse and land cover classes were identified. These were crop land ,Barren land,forest , water bodies and built up land. This study identified population growth, built up land and lack of proper education as causes of the changes in land use and land cover in the Coimbatore area.

Keywords: land cover change, land use change, IRS IC, remote sensing and Geographical Information System

INTRODUCTION

The recent availability of high-resolution satellite imagery has led to increased interest in the use of satellite data for large scale mapping applications and detailed land use assessments. This growing interest not only emanates from the fact that satellites provide a synoptic coverage, have a high repetitive cycle, and carry multispectral band sensors that provide information beyond the ordinary ability of the human eye, but also because they offer a costeffective source of data that enables timely detection of changes to the landuse and landcover, the monitoring and mapping of urban development, assessment of deforestation extents, evaluation of post fire vegetation recovery, the revision of topographic maps among numerous other environmental assessments.

Land use and land cover information are important for several planning and management activities concerned with the surface of the earth because it constitutes key environmental information for many scientific, resource management and policy purposes, as well as for a range of human activities.

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An accurate knowledge of land use and land cover features represents the foundation for land classification and management. Therefore a wide range of scientists and practitioners, including earth systems scientists, land and water managers as well as urban planners seek information on the location, distribution, type and magnitude of land use and land cover change.

Vegetation changes are often the result of anthropogenic pressure (e.g. population growth) and natural factors such as variability in climate. Due to increasing population growth rates, there have been increasing rates of conversion of forest and built up land in developing economies all over the world. The degradation of forest have impact on catchment processes and biochemical cycles and leads to soil erosion and water shortage not only in the regions immediately affected by deforestation, but also in reasonably distant areas .This means that problems posed by land use and land cover change are numerous and have serious consequences.

Therefore, the spatial dimensions of land use and land cover needs to be known at all times so that policy-makers and scientists will be amply equipped to take decisions. The most important thing is the changing pattern of land use and land cover reflect changing economic and social conditions.

2. STUDY AREA

Coimbatore, District is situated on the banks of river Noyyal between 11° 00' of north latitude and 77° 00' of East longitude. The total area of Coimbatore district is 254 square km. Coimbatore is located at an elevation of about 398 meters. The mean maximum and minimum temperatures during summer and winter varies between 35°C to 18°C. Highest temperature ever recorded is 41 °C and lowest is 12 °C. Coimbatore is situated in the extreme west of Tamil Nadu, near the state of Kerala. It is surrounded by mountains on the west, with reserve forests and the (Nilgiri Biosphere Reserve) on the northern side. The eastern side of the district, including the city is predominantly dry. The entire western and northern part of the district borders the Western Ghats with the Nilgiri biosphere as well as the Anaimalai and Munnar ranges. It is the third largest district of Tamil Nadu. This district is known as the Manchester of South India and is known for its textile factories, engineering firms, automobile parts manufacturers, health care facilities, educational institutions, and hospitality industries. The hill stations of Ooty, Coonnor and Valparai are close to the city making it a good tourist attraction throughout the year. The district is situated on the banks of the Noyyal River and is close to the Siruvani Waterfalls. This district contains four main reservoir that is Aliar,Thirumurthi ,Amaravathi and Solaiar.

3. DATA AND IMAGERY USED

IRS IC and IRS IA imageries were collected from Water Research Institution,Tharamani, Chennai.Topo Sheet 58 A,58E,58B and 58 F were collected from Survey of India,Map Sales office, Chennai.

4. IMAGE PROCESSING

IRS IC images of scene of year 1990 and 2000 showing the roads, towns, and drainage systems were used for the study. Remote sensing softwares: Erdas Imagine version 9.2 and ArcGIS version 9.2 were used for the processing of the images. The raw satellite image was converted from Tag Image file format (Tiff) to img format using Erdas in order to be compatible with other Erdas Imagine files. The layers were stacked and sub-set to delineate the catchment area for classification. The UTM Zone 30N Coordinate on the WGS 84 was used to geocode the imported image. This was followed by georeferencing using the Traverse Mercator projection with reference units in meters to allow compatible positioning of other themes such as roads, towns and drainage which were already digitized in that format. Then the digitized map showing the roads, towns, drainage and the outline of the reservoir was overlaid on the georeferenced image. Band combination of red, blue and green was used to display the raw images in standard colour composites. The spectral band combination for displaying images often varies with different applications (Trotter, 1998). This was necessary for the visual interpretation of the images. A band combination of red, blue and green (RGB) is often used to display images in standard colour composites for land use and vegetation mapping (Trotter, 1998). In this study, the IRS IA 2000 images were displayed in a band combination of 3,2 and 1 (red, blue and green), which is standard for visual interpretation of land use and land cover mapping in the tropics (Prakash and Gupta 1998; Trotter, 1998).The 1990 imagery is visually interperted by using ArcGIS (Version 9.1)

4.1 Land Cover Classification

The supervised classification method was used to classify the images into the various land cover categories. The maximumlikelyhood supervised classification method is applied for grouping the pixel in IRS IC 2000 imagery. . The selection of appropriate training areas is based on the analyst's familiarity with the geographical area and their knowledge of the actual surface cover types present in the image. Thus, the analyst "supervises" the categorization of a set of specific classes. The numerical information in all spectral bands for the pixels comprising these areas are used to "train" the computer to recognize spectrally similar areas for each class.

- **Training Pixels**

Training fields are areas of known identity delineated on the digital image, usually by specifying the corner points of a rectangular or polygonal area using line and column numbers within the coordinate system of the digital image. The analyst must, of course, know the correct class for each area. Usually the analyst begins by assembling maps and aerial photographs of the area to be classified. Specific training areas are identified for each informational category following the guidelines outlined below. The objective is to identify a set of pixels that accurately represents spectral variation present within each information region (Fig. 1a,1b).

Training area process is called signature creation is shown in the following figure5a,5b. In the figure some of the classes like cropland, water body, barren land and hills were chosen as training area. In this process the red pixels are trained as cropland, block pixels are trained as water body or tank, the ash green pixels are trained as barren land and dark gray pixels selected as Hills continue this process according to our classification scheme.

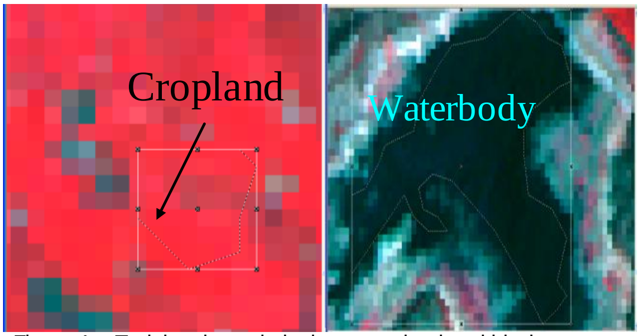

Figure 1a .Training the red pixels as cropland and block texture as waterbody

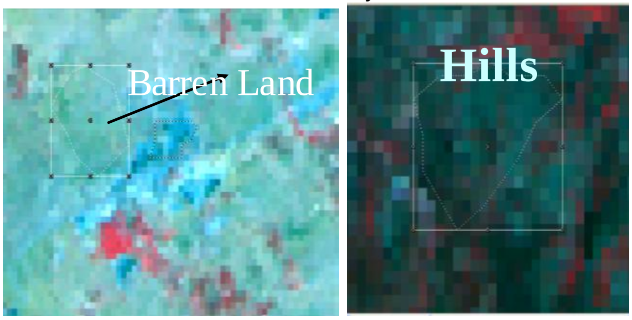

Figure 1b. Training the pixel as Barren Land and Hills

The statistics of the various classes were generated using the Erdas Imagine programme.Finally maps were composed, using programme and the maps were validated in the field to assess its accuracy. This was conducted through field visit to define how closely the classification agrees with the actual field situation. It involved the selection of samples of identified locations on the map, which were then checked in the field.

4.2 Change Detection

There are lots methods are available to find out the change detection in land. The most frequently used land change detection methods includes i) image overlay ii) classification comparisons of land cover statistics iii) change vector analysis iv) principal component analysis and v) image rationing and vi) the differencing of normalized difference vegetation index (NDVI) (Duadze, 2004). This research used classification comparison of land cover statistics. This method was adopted because the study to find out the changes in the areas of the various land cover categories. Using the post-classification procedure, the area statistic for each of the land cover classes was derived from the classifications of the images for each date (1990 and 2000) separately, using functions in the Erdas Imagine software. The areas covered by each land cover type for the one decay were compared. Then the directions of the changes in each land cover type 1990 and 2000 were determined.

5.RESULT DISCUSSION

5.1 Results of land cover classification

There are totally seven categories were identified and classified in this study. They are water body, forest, settlement, cropland, barren land, fallow land and others (doesn't include above categories). The classification of these categories were shown in the Figure 2

Land Cover Classification of 1990 and 2000 IRS IC Imageries

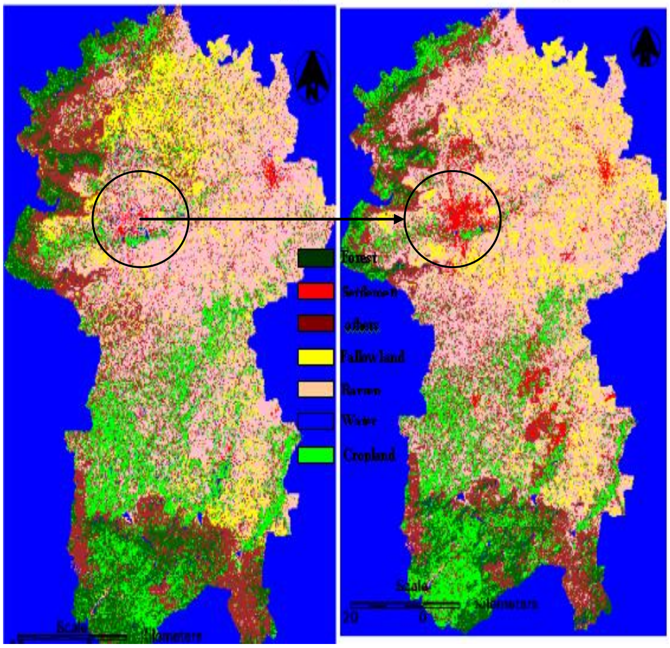

Figure 2.Land Cover Classification 1990 and 2000 Imageries

5.2. Land cover changes for one decay

Table 1 shows the changes in the various land use and land cover categories (in sq.km and percentages) during the periods between 1990 to 2000.In the table (+) denotes that the percentage increased and (-) denotes that the percentage decreased.

TABLE 1.

LAND COVER CHANGES IN THE PERIOD OF 1990 TO 2000

Classification	LANDUSE 1990 Sq.km	LANDUSE 2000 Sq.km	CHANGE DURING 1990-2000	
			Sq.m	Percentage%
Waterbodies	1618.130	1573.68	44.450	0.51(-)
Settlement	112.161	633.02	520.859	5.94(+)
Forest	1370.413	1522.02	151.607	1.73(+)
Crop Land	912.531	1141.09	228.559	2.61(+)
Barren Land	4563.534	2346.77	2216.764	25.29(-)
Fallow Land	163.38	533.75	370.370	4.22(+)
Others	26.334	1016.15	989.816	11.29(+)
Total	8766.483	8766.48		

5.3. Causes of the land cover changes

In the period of one decay settlement was increased up to 12% this proves the population growth. Population growth is the basic factor for environmental change, because this is key factor for all development especially in developing countries like India. In the below figure 3 we can see the changes in settlement in 2000. Fortunately the percentage of water body was only 1% decreased. In the total area 8766.483 sq.km 3% of forest was increased. The percentage of fallow land was increased and barren land was decreased. Mainly the cropland was increased upto 5%. This is shown in the figure 3.

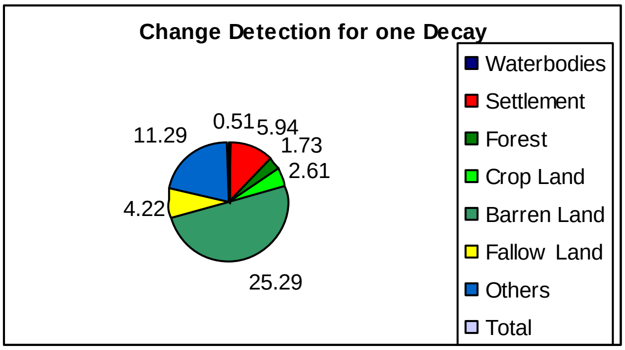

Figure 3.Change Detection Chart for one Decay

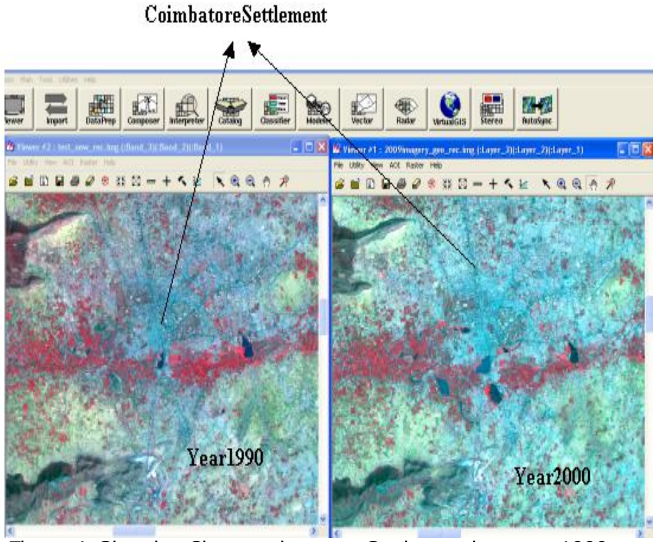

Figure 4. Showing Changes between Settlement between 1990 to 2000

In the figure 4 compare with left side imagery with right imagery settlement(sky blue texture) ,cropland(Red color)and waterbodies(Block color) were increased in the one decay.

6.CONCLUSIONS

In the analysis of IRS IC Images 1990 and 2000 exposed that land use and land cover of Coimbatore settlement has changed over the one decay. Seven classes of land use and land cover were identified and mapped using above imagery. The used classes were waterbodies,forest,settlement,crop land fallow land,barren land others.generally if settlement was increased then growth of population will increase. This is proved by increment in the Coimbatore settlement. Therefore based on the population growth the land use and land cover trend is changed.But only few percentage of water was decreased.

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