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RESEARCH ARTICLE

LAND USE/LAND COVER CLASSIFICATION OF NAGAPATTINAM SOUTHERN COASTAL REGION, TAMILNADU, INDIA - USING REMOTE SENSING AND GIS

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ABSTRACT

The study area represented in the Toposheet 58 N/13, N/14 and N/15 spread between the North latitude 10°13´ 30" and 10°51´30" and Longitudes 79°43´30" and 79°52´30" of Nagapattinam southern coastal region. Satellite imagery is used to identify the Land use/ Land cover status of the study area. The software like ERDAS 9.3 and Arc GIS 10.1 are used to demarcate the land use / Land cover features of Nagapattinam southern coast. Remote sensing and GIS provided consistent and accurate base line information than many of the conventional surveys employed for such a task. Supervised Classification Technique was applied to Landsat images in 1999 and 2009 data. Image Classification of seven reflective bands of two Landsat images is carried out by using maximum likelihood method with the aid of ground control point from SOI toposheet dated 1970. The result indicates that severe land cover changes have occurred in built-up land, agriculture land, has been experienced in the region between the 1999 and 2009. Mainly Land use and Land cover changes are occurring in coastal area region. The result of the work shows a rapid growth in built-up land between 1999 and 2009.

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INTRODUCTION

Land use/land cover (LULC) changes play a major role in the study of global change. Land use/land cover and human/natural modifications have largely resulted in deforestation, biodiversity loss, global warming and increase of natural hazards (Prenzel *et al*., 2004). This environmental problems are frequently occurs related to LULC changes. So, available data is used in LULC changes. It can provide critical input to decision to make of environmental management and planning of the future. When growing population and increasing socio economics are creates a LULC changes (Seto, *et al*., 2002). The LULC alterations are generally caused by mismanagement of agricultural, urban, aquaculture pond and forest lands which lead to severe environmental problems such as tsunami, floods etc. Remote sensing and Geographical Information Systems (GIS) are powerful tools to derive accurate and timely information on the spatial distribution of land use/land cover changes over large areas (Carlson *et al*., 1999; Guerschman *et al*., 2003) Past and present studies conducted by organizations and institutions around the world, mostly, has concentrated on the application of LULC changes. Remote sensing imagery is the most important data resources of GIS. Satellite imagery is used for recognition of synoptic data of earth's surface (Ulbricht *et al*., 1998). Landsat Multispectral Scanner (MSS), Thematic Mapper (TM) and Enhanced Thematic Mapper Plus (ETM+) data have been broadly employed in studies towards the determination of land cover since 1972, the starting year of Landsat program, mainly in forest and agricultural areas (Selçuk Reis, 2008). The rich archive and spectral resolution of satellite images are the most important reasons for their use. In this study, change detection comparison (pixel by pixel) technique was applied to the Land use\land cover maps derived from satellite imagery. Therefore, attempt will be made in this study to map out the status of land use land cover of Nagapattinam southern coastal region between 1991 and 2010 with a view to detecting the land consumption rate and the changes that has taken place in this status particularly in the built-up land so as to predict possible changes using both Geographic Information System and Remote Sensing data.

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Study area

The study area represented in the Toposheet 58 N/13, N/14 and N/15 spread between the North latitude 10°13´ 30" and 10°51´30" and Longitudes 79°43´30" and 79°52´30" of Nagapattinam southern coastal region (Fig:1) . The prominent geomorphic features identified in the study area are alluvial

plains, back water, beach, mud flat, paleo channel, river, salt pan, swales, and swamps. This is a port city with a harbor nestled with commercial, residential and fisheries land usage. National highways and railway line lay few meters away from the coastline.

Methods and approach

Landsat TM and Landsat TM (path 142, row 53) were used in this study. The Landsat TM image (1999) and Landsat TM image (2009) was downloaded from Global Land Cover Facility. Global Land Cover Facilities (GLCF) Landsat TM image (1999) was provided by a commercial data provider. 1068.50 sq km of subset was used from these Landsat images. Landsat TM has a 28.5 m and Landsat TM 28.5 m spatial resolution. All visible and infrared bands (except the thermal infrared) were included in the analysis. Remote sensing image processing was performed using ERDAS Imagine 9.3. Other materials also used are aerial photos and standard topographic maps.

Image classification

In this study, totally, ten LULC classes were established as agriculture, aquaculture, barren land, built-up land, fallow land, plantations, salt affected area, scrub land and water bodies. Description of these land cover classes are presented in (Table: 1). Two dated Landsat images were compared supervised classification technique. In the supervised classification technique, two images with different years are independently classified. A Supervised classification method was carried out using training areas and test data for accuracy assessment. Maximum Likelihood Algorithm was employed to detect the land cover types in ERDAS Imagine 9.3. The land use/land cover spatial distribution maps were prepared from Landsat data in GIS platform and are shown in (Fig: 2 & 3).

Agriculture land

The land primarily used for farming and for production of food. It includes land under crops (irrigated and unirrigated),

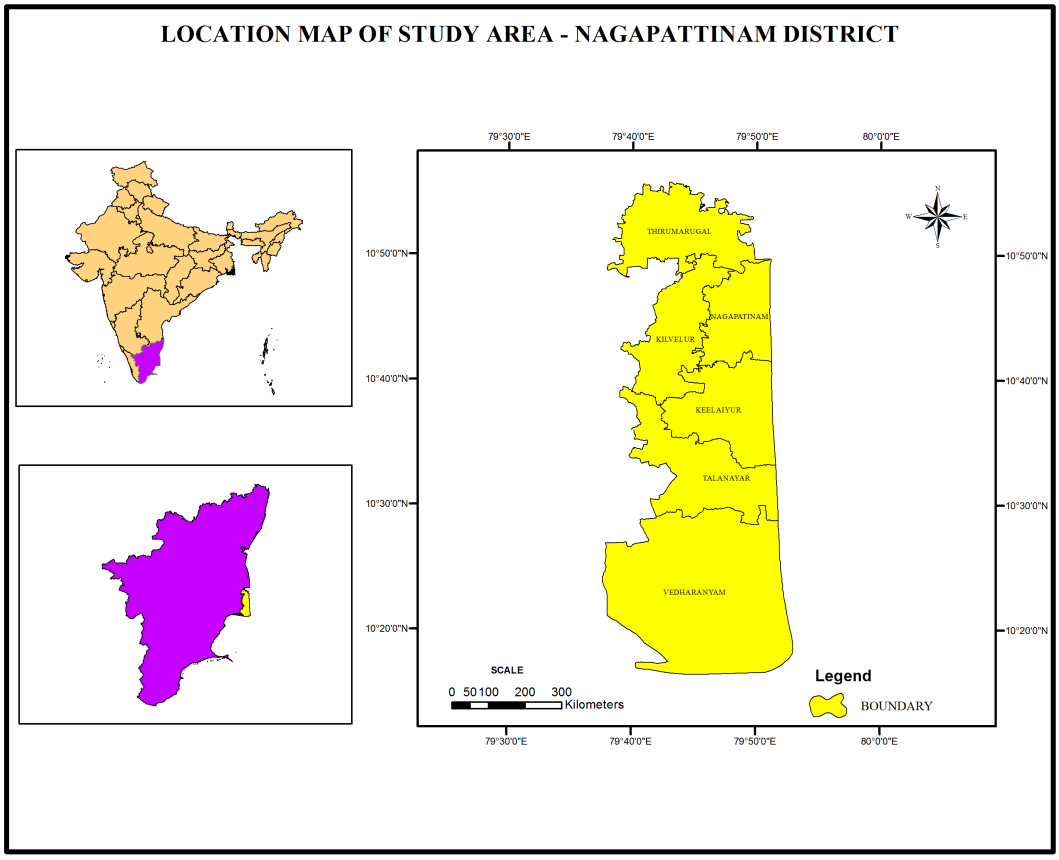

Fig. 1. Location map of the study area

Table 1. Land use/Land cover changes Nagapattinam Southern coastal region

S.No.	Land Use/ Land Cover	1999		2009	
		Area Sq Km	Percentage	Area Sq Km	Percentage
1.	Agriculture Land	408.48	38.23	343.21	32.10
2.	Aquaculture/Saltpan	48.58	4.55	69.86	6.53
3.	Back Water	45.92	4.30	25.92	2.42
4.	Barren Land	185.82	17.39	223.87	20.94
5.	Built-up Area	51.18	4.79	78.39	7.33
6.	Fallow Land	144.95	13.57	129.34	12.10
7.	Plantations	20.36	1.91	29.54	2.76
8.	Salt Affected Land	40.85	3.82	35.39	3.31
9.	Scrub Forest	85.29	7.98	88.18	8.25
10.	Water Body	37.07	3.47	44.8	4.19
	Total	1068.50	100	1068.50	100

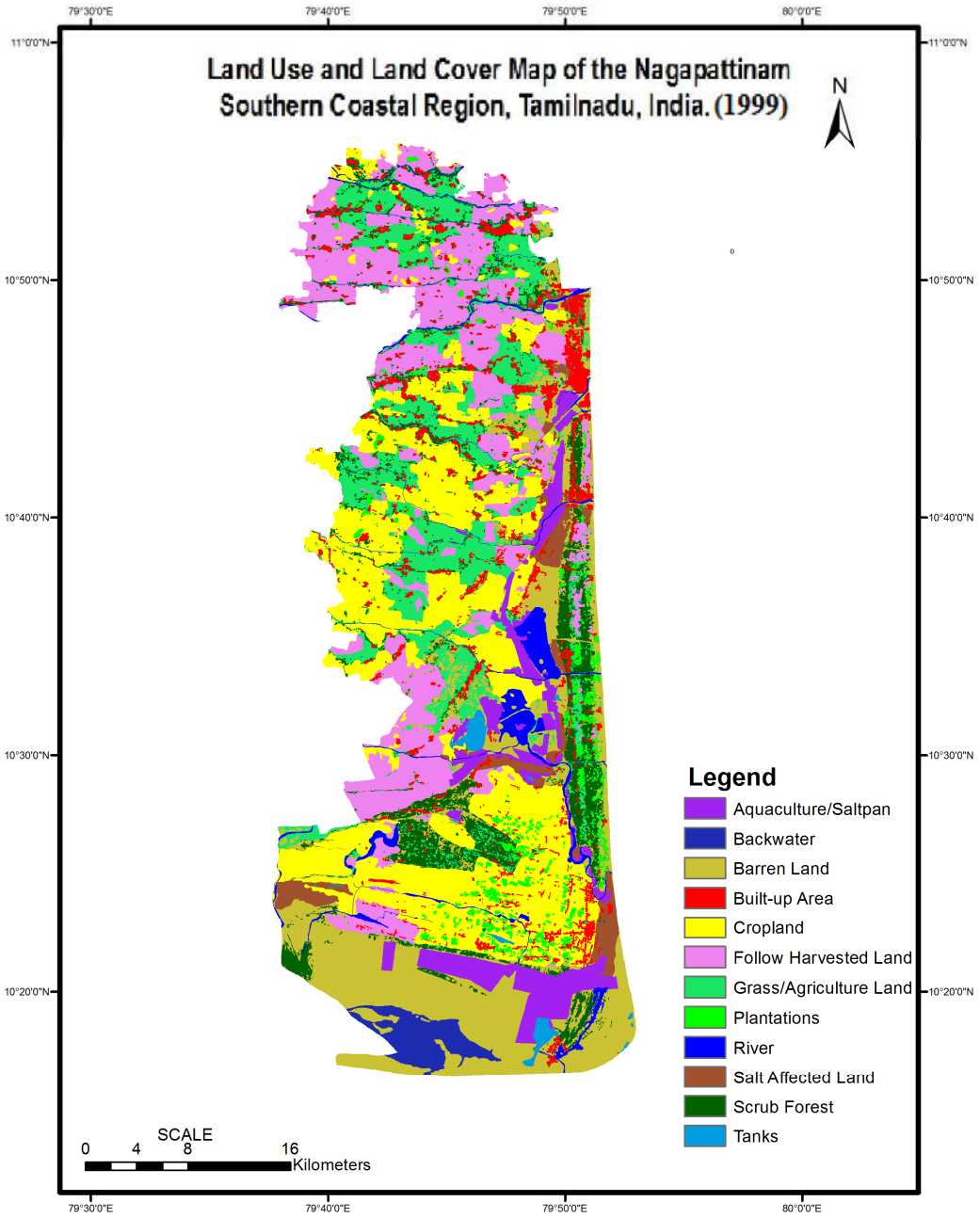

Fig.2. Land use/Land cover map of the study area

fallow land and plantations and were observed in the field. The results of the analysis of satellite data for the year 1999 and 2009 are given below. The correlated year of 1999-2009 agricultural land was 408.48 Sq.km (38.23%), 343.21 sq km (32.10%) and it was gradually reduced.

Aquaculture/Saltpan

The aquaculture pan is generally observed in the regions that are near to the seashore. It is identified by its light blue or white color, medium to coarse texture and well developed pattern. The areas occupied by aquaculture pans are very small and their areal coverage is 1999-2009 was 48.58 sq km (4.55%), 69.86 (6.53%) and it is slightly increased.

Back Water

The back water was 45.92 sq km (4.30%) in 1991 and 25.92 sq km (2.42%) in 2009. Barren land was 185.82 sq km (17.39 %) in 1991 and 223.87 sq km (20.94%) in 2009.

Built-up area

Built-up land is defined as an area of human habitation which has a cover of buildings, transportation, communication utilities in association with water, vegetation and vacant lands. Moreover, they are sparsely present in the entire study area. The built-up-land occupied an area of 1999-2009 is 51.18 sq km (4.79%), 78.39 sq km (7.33%), respectively in the study area.

Fallow land

Fallow land is described as agricultural land, which is taken up for cultivation, but it is temporarily allowed to rest un-cropped for one or more seasons, but not less than one year. These lands are particularly those which were seen devoid of crops at the time when the satellite imagery was taken of both seasons. The total area occupied under the agricultural fallow land was 1999-2009 is 144.95 sq km (13.57%), 129.34 sq km (12.10%) and it is slightly decreased.

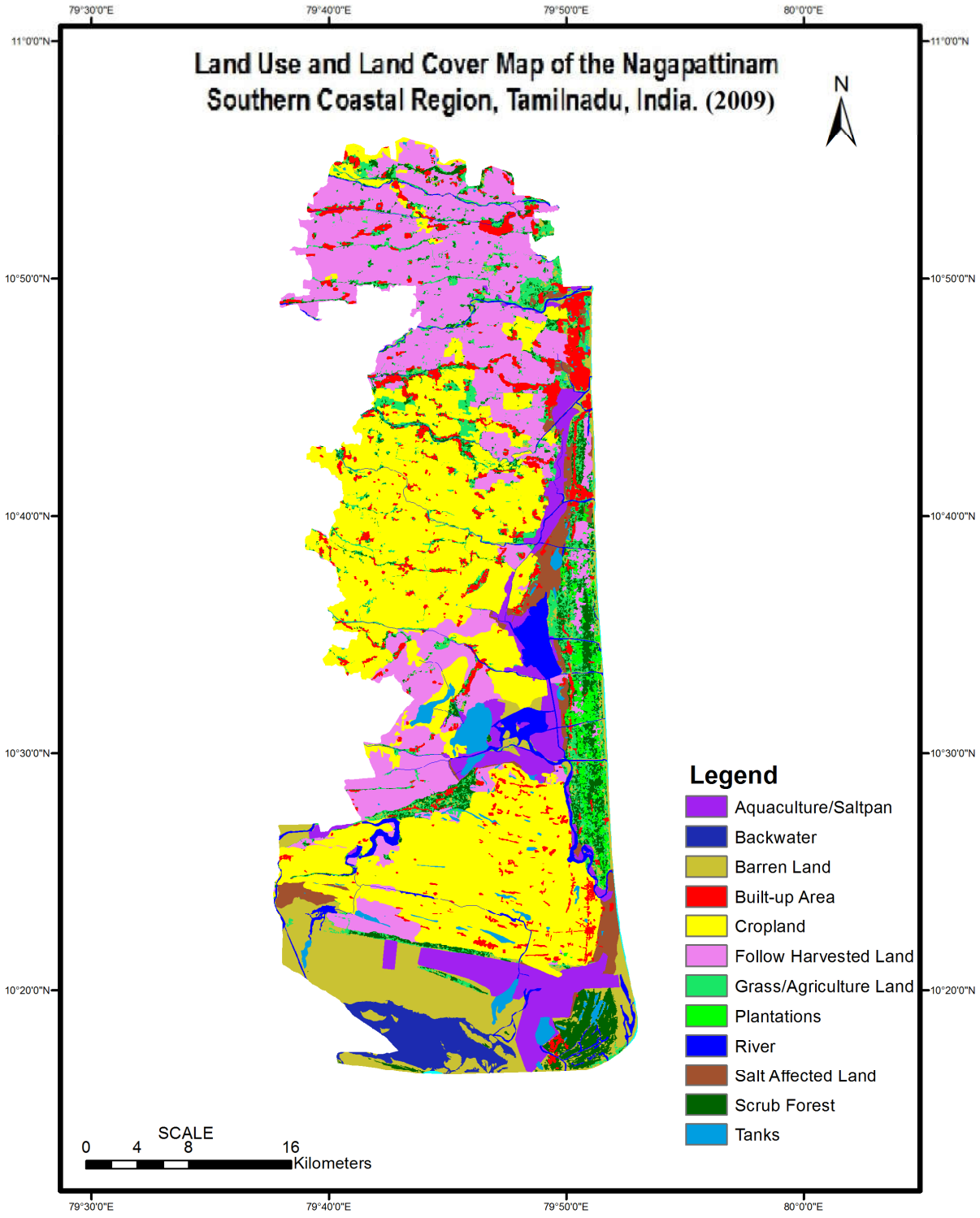

Fig.3. Land use/Land cover map of the study area

Plantations

These plantations land occupied with an area of 1999 – 2009, 20.36 sq.km (1.91%), and 29.54 sq km (2.76 %) of the total area. These include areas were crops such as palm trees, coconut, casuarinas etc. In the satellite imagery this category was identified from the Gray color, irregular in shape, smooth texture and contiguous to non-contiguous pattern. In the study area such plantation were found to occur from 20.36 sq km (1.91%), 29.54 sq km (2.79%), Topudiurai to Vettaikaranirppu is continuous patches of parallel to the shoreline.

Salt affected lands

These salt affected lands occupied with an area 1999, 40.85 sq km (3.82 %), 2009, 35.39 sq km (3.31%), of the total area. These are lands, which are characterized by the presence of excess soluble or, high exchangeable sodium. These results mainly due to prolonged are of the land for agricultural lands. They appear in yellow tone or in some areas as light yellow tone. They are irregular and discontinuous in shape, and occur close to the agriculture areas. In the study area such salt affected lands are found in all parts.

Scrub forest

These scrub land occupied with an area 85.29 sq km (7.98 %), 88.18 sq km (8.25%) of the total area. This land use type is subjected to degradation of erosion. The scrub may be thorny or mixed jungle. These areas in the satellite data were dark red in tone. In the study area were major patches of scrub land found in the villages Marudur Vadakku, Vadamazhai, Chetipulam, Ayyankaranpulam, Kuravapuram and Katharaipuram area. It is also occupied form Periyakutagai to Vadakku Poigainallur.

Water bodies

Water bodies are an area of impounded water, areal in extent and often with a regulated flow of water. It includes man-made lakes/tank/canals, besides river/stream and creeks and observed in the field. The total area occupied by water bodies in the study area was 1999-2009 is 37.07 sq km (3.47%), 44.80 sq km (4.19%).

Conclusion: Agricultural lands were mostly located in the region with 0-7 m of altitude. Because those areas are very qualifies for cultivation. Even though, many people like residing in coastal area. The lands converted in to built-up area are covered in agricultural, forest some places barren land especially densely populated coastal regions. This conversion especially occurred in built-up in rural areas because of the migration to the cities. These lands are usually filled alluvial plains by coastal floods, and sand in the bank of streams. The beach in barren land classes is expanded by filling materials; these regions increase 3.55% deposit in different places in 1999 and 2009. There are conversions to built up land class from all kinds of classes of lands, but the conversion from barren land is relatively less. A long with the increase in population, Nagapattinam, Vellankanni and Vedaraniyam town are enlarged by the conversion of neighboring agriculture areas in to residential areas. Similarly, because of the structuring pressure on river bank regions and coastal areas, small amount of barren land in those areas are converted in to residential areas. The mudflat areas convert to aquaculture ponds is originated from filling the coastal areas.

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