

**LAND USE AND LAND COVER CHANGE STUDIES IN  
NAGAPATTINAM DISTRICT, USING REMOTE SENSING AND GIS**

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## **SYNOPSIS**

### **Introduction**

Land is the most important component for any kind of life to sustain. But globally, our environment totally affected due to climatic changes, lack of rainfall, loss of agricultural land, resource utilisation, deforestation, increasing rate of water utilization and various types of pollution. The utilization pattern of the land resource on a temporal basis. Each scientist's make efforts to study and understand the mother earth in totality and certain how the available precious resources and used for the development of the present society as well as the future generations in a friendly and in an economically sustainable environment. It can be noted that most of our civilizations were established on the banks of river systems that too, along the deltaic plain. The study area too has a vast coastal with deltaic region and recently the man- made features like built-up lands of this area have been increasing in this region.

The Land utilization is to give the optimum use but not maximum use of land, especially in the rural and urban areas where the land is having higher economic value. The land value is increase because of, increasing the requirements for infrastructural facilities. Most of the agricultural lands have been converted into built-up lands. It has also been observed that in most of the cases the use of land is found to be not in agreement with the regulation specified by the planning authorities in rural and urban areas.

Land Cover changes can be identified from Remote Sensing imagery taken out from the same area in different times (Sheppard 1964). Change detection can be

performed manually by means of visual interpretation of the imagery, a Satellite imagery in a digital format has become available, digital change detection techniques have been developed. An increasingly common application of remotely sensed data is for change detection. Change detection is the process of identifying differences in the state of an object or phenomenon by observing it at different times (Singh, 1989).

The study area under investigation lies in between the latitudinal extension is from 10°12'0" North to 11°24'0" North and the longitudinal extension is from 79°24'0" East to 80°20'0" East. The general geological formation of the district is plain and coastal. The Cauvery is the principal river of this study area. Nagapattinam district lies on the east coast of Tamil Nadu. It extends to an area of 2715.83sq.kms. The district has totally 491 Villages, 7 taluks and 11 blocks namely Keelaiyur, Kilvelur, Kollidam, Kuthalam, Mayiladuthurai, Nagapattinam, Sembanarkoil, Sirkazhi, Thalainayiru, Thirumarugal and Vedaranyam. These blocks are further subdivided into 10 town panchayats and 433 village panchayats.

### **Aims and Objectives of the study**

The aim of this study is to analyse a land use and land cover of Nagapattinam district at different approaches in order to detect the changes that have taken place particularly in the agriculture and built-up land and subsequently predict likely changes that might take place in the same over a given period. The following specific objectives will be realized in order to achieve the aim stated above.

1. To study the land use and land cover in Nagapattinam district.
2. To calculate the 9 fold classification and the changes of cropping pattern using 'G'-return hand book for the year 2005-06 and 2015-16.

3. To study the block level land use and land cover changes for the years 1990, 2000 and 2010 using satellite imageries.
4. To calculate the year wise changes in land use and land cover.
5. To calculate the land use and land cover changes using least squares method.

### **Methodology and Data Base**

The study is to understand the state of the **past**, present and future land use and land cover change in Nagapattinam district. The methodology adopted here is based on a hybrid approach of visual and digital techniques and analysis with GIS. The overall methodology adopted for the preparation of land use and land cover map and change analysis is shown with the help of a flow chart. Digital image processing techniques have been applied for preparation of land use and land cover maps from the multi-data and satellite data. Erdas Imagine image processing software and its GIS analysis capabilities (Vector module) have been used for the preparation of multi-data land use and land cover maps.

### **Land Use and Land Cover Change Detection in Nagapattinam District**

Land use and land cover plays wide role in the part of urban development. These changes generally take place in the decrease of agricultural land due to the causes of urbanization. The satellite imageries are LANDSAT TM (1990), LANDSAT TM (2000) AND LISS III (2010) data are used. 1990, 2000 and 2010 covering a period of twenty years and the aerial distribution of the land use and land cover changes have been observed. The changes were identified with the Agricultural land, Barren land, Built-up land, Fallow land and Scrub land. The land use and land cover maps are prepared by using GIS software to evaluate the changes and it showed a strong variation.

Generally in this study primarily there has been the land use and land cover categories are Agricultural land, Aquaculture land, Backwater land, Barren land, Built-up land, Canal, Fallow land, Plantations, River, Salt affected land, Scrub land and Tanks.

### **Agricultural Land**

Lands are showing a remarkable decrease in different areas of this district. In 1990 the Agricultural land occupied an area of 1025.51 sq.km. In 2000 the agricultural land occupied an area of 955.78 sq.km. In 2000 compared to 1990 in the ten years of period the agricultural land has decreased 2.57 per cent. The agricultural land has highly concentrated areas are Kollidam, Sirkazhi, Sembanarkoil, Mayiladuthurai, Thirumarugal, Nagapattinam, Keelaiyur, Kilvelur and Thalainayiru blocks. In 2010 agricultural land was occupied an area of 907.83 sq.km. From 2010 compared to 2000 the agricultural land shows other decreased of 1.77 per cent. In 2010 compared to 1990 the agricultural land has total decreased 4.34 per cent. Over all agricultural lands decrease in this district 26.22 per cent. It resulted in the increase of fallow land and built-up lands.

### **Aqua Culture / Saltpan Land**

In 1990 the Aquaculture / Saltpan land occupied an area of 83.22 sq.km. Aquaculture/ Saltpan land was identified in the blocks are Nagapattinam, Keelaiyur, Kilvelur, Kollidam, Mayiladuthurai, Sirkazhi, Sembanarkoil, Thalainayiru, Thirumarugal and Vedaranyam. In 2000 compared to 1990 the ten years of periods the aquaculture / saltpan land was increased to 0.83 per cent. In 2000 the Aquaculture / Saltpan land was found to be 105.76 sq.km. In 2010 compared to 2000 in the ten years of period the aquaculture/ saltpan land was increased to 0.42 per cent, it was identified in Nagapattinam, Keelaiyur, Kilvelur, Kollidam, Kuthalam, Mayiladuthurai, Sirkazhi, Sembanarkoil, Thalainayiru, Thirumarugal and Vedaranyam. In 2010 the aquaculture / saltpan land occupied an area of 17.08 sq.km. In 2010 compared to 2000 the Aquaculture / Saltpan land was increased to be 1.25 per cent. Overall changes in Aquaculture / Saltpan land were 7.55 per cent.

### **Back Water**

In 1990 the Back water area was occupied an area of 55.45 sq.km. Backwater land was identified in the blocks are Nagapattinam, Kollidam, Sirkazhi, Sembanarkoil, Thirumarugal and Vedaranyam. In 2000 compared to 1990 the ten years of periods the Backwater land was increased to 0.91 per cent. In 2000 the backwater land was found to be 55.65 sq.km. In 2010 compared to 2000 in the ten years of period the backwater was decreased to 0.15 per cent, back water was identified in the blocks are Nagapattinam, Kollidam, Sirkazhi, Sembanarkoil, Thirumarugal and Vedaranyam. In 2010 the backwater was occupied an area of 51.85 sq.km. In 2010 compared to 1990 the backwater land was decreased to be 0.14 per cent. Overall changes in Backwater land was 7.55 per cent.

### **Barren Land**

In 1990 the Barren land was occupied an area of 323.55 sq.km. The barren land was identified in the blocks are Kollidam, Sirkazhi, Sembanarkoil, Mayiladuthurai, Thirumarugal, Nagapattinam, Keelaiyur, Kilvelur and Thalainayiru blocks. In 2000 compared to 1990 the ten years of periods the barren land was increased to 1.3 per cent. In 2000 the barren land was found to be 358.87 sq.km. In 2010 compared to 2000 in the ten years period the barren land decreased to 0.15 per cent. The barren land has been identified in the blocks are Kollidam, Sirkazhi, Sembanarkoil, Mayiladuthurai, Thirumarugal, Nagapattinam, Keelaiyur, Kilvelur and Thalainayiru blocks. In 2010 the barren land was occupied an area of 354.69 sq.km. In 2010 compared to 1990 the barren land was increased to 1.15 per cent. Overall changes in barren land were 6.94 per cent. Because of failure of monsoon for long period of this district. The agricultural lands are converted into these kinds of land. Multi cropping fields are brought down into two crops and one crop fields for the long period of time of this Nagapattinam district. It is the very most important reason to have higher growth of barren lands was found in this district.

### **Built – Up Land**

Built-up land is highly concentrated in this district. The built-up land lands are identified in entire areas of this study area. In this centre portion are the urban areas which are highly developed.

Generally some agricultural land fields were converted into fallow land after a few months the land was converted into new residential areas and industrial areas were newly created in entire sides of national highway lines. In this district have well developed transportation facilities. The built-up lands were occupied not only settlements, various facilities are found such as Government offices, Private offices, Educational institutions, Medical centers, Pilgrimage centers, Industries, Factories, Marketing places, Trading centers, Harbour and many small scale Industries are also were identified in the blocks are Kollidam, Sirkazhi, Sembanarkoil, Mayiladuthurai, Thirumarugal, Nagapattinam, Keelaiyur, Kilvelur and Thalainayiru blocks. In 1990 the Built-up land was occupied an area of 232.58 sq.km. Built-up lands shows increasing level of these areas. In 2000 compared to 1990 the years of built-up land 1.13 per cent has been increased. In 2010 compared to 2000 the built-up land 3.09 per cent, in 2010 compared to 1990 the built-up land 4.22 per cent has been increased in this area. Overall built-up lands increase is 25.49 per cent in this district. So many agricultural lands were transformed to fallow land and barren lands.

### **Canal**

The Cauvery and Kollidam rivers are the most important water bodies of Nagapattinam district and their tributaries of Cauvery and Kollidam. The water bodies like canal show a Kollidam and Mayiladuthurai block of this block. During 1990 the total area was 7.09 sq.km and the same value is shown in 2000 and 2010 respectively. It shows the blocks are Nagapattinam, Keelaiyur, Kilvelur, Kollidam, Kuthalam, Mayiladuthurai, Sirkazhi, Sembanarkoil, Thalainayiru, Thirumarugal and Vedaranyam. There is no changes is shown in the canal land use.

### **Fallow Land**

In 1990 the Fallow land was occupied an area of 371.99 sq.km. The fallow land was identified in the blocks are Nagapattinam, Keelaiyur, Kilvelur, Kollidam, Kuthalam, Mayiladuthurai, Sirkazhi, Sembanarkoil, Thalainayiru, Thirumarugal and Vedaranyam. In 2000 compared to 1990 every ten years of period the fallow land was decreased to 2.4 per cent. In 2000 the fallow land was found to be 306.7sq.km. In 2000 the fallow land was increased highly. In 2010 compared to 2000 in the ten years period the fallow land was found in 2.09 per cent. The fallow

land were identified in the blocks Nagapattinam, Keelaiyur, Kilvelur, Kollidam, Kuthalam, Mayiladuthurai, Sirkazhi, Sembanarkoil, Thalainayiru, Thirumarugal and Vedaranyam. In 2010 the fallow land was occupied an area of 363.58 sq.kms. In 2010 compared to 1990 the fallow land was decreased to be 0.31 per cent. Over all changes in the fallow lands 1.87 per cent in this district.

### **Plantations**

In 1991 the Plantation land was occupied an area of 224.04 sq.km. Plantation land was identified in the blocks are Nagapattinam, Keelaiyur, Kilvelur, Kollidam, Kuthalam, Mayiladuthurai, Sirkazhi, Sembanarkoil, Thalainayiru, Thirumarugal and Vedaranyam. In 2000 compared to 1990 the ten years of periods the plantation land was increased to 1.56 per cent. In 2000 the barren land was found to be 266.22 sq.km. In 2010 compared to 2000 in the ten years period the plantation land was decreased to 4.35 per cent of this district. In 2010 the plantation land was found to be 148.09 sq.km. In 2010 compared to 1990 the plantation land was found to be decreasing level 2.79 per cent. Over all changes in plantation lands was decreased in 16.85 per cent. Because of failure of monsoon, poor climatic conditions, lack of rainfall and poor water facilities of this district. There are many plantations land was modified to built-up land of this Nagapattinam district.

### **River**

The Cauvery is the most important river of this district. The Kollidam is another important river and its tributaries are Odampokki, Mullaiyaru Nandalar, Vallaparu, Adapparu, Thirumalairajanaru, Arasalaru, Manjalaru, Harichandranadhi, Veeracholanaru, Ayyapanaru, Cauvery and Vikramanaru they are flows in this district. Cauvery is one of the major rivers in south India and Tamil Nadu. This spread across the states of Kerala, Karnataka and Tamil Nadu. In the river area was 84.08 sq.km in 1990, 2000 and 2010 respectively. So, there is no change this river land use.

### **Salt Affected Land**

In 1990 the Salt affected land was occupied an area of 95.17 sq.km. The salt affected land was identified in the blocks are Nagapattinam, Keelaiyur, Kilvelur, Kollidam, Kuthalam,



Mayiladuthurai, Sirkazhi, Sembanarkoil, Thalainayiru, Thirumarugal and Vedaranyam. In 2000 compared to 1990 the ten years of periods the salt affected land was increased to 0.72 per cent. In 2000 the salt affected land was found to be 114.8 sq.km. In 2010 compared to 2000 in the ten years period the salt affected land was increased to 0.54 per cent of this district. In 2010 the salt affected land was found to be 129.39 sq.km. In 2010 compared to 1990 the salt affected land was increased to 1.26 per cent.

### **Scrub Land**

In 1990 the Scrub land was occupied an area of 194.58 sq.km. The Scrub land was identified in the blocks is Nagapattinam, Keelaiyur, Kilvelur, Kollidam, Kuthalam, Mayiladuthurai, Sirkazhi, Sembanarkoil, Thalainayiru, Thirumarugal and Vedaranyam. In 2000 compared to 1990 the ten years of periods the scrub land was decreased to 0.2 per cent. In 2000 the scrub land was 198 sq.km. In 2010 compared to 2000 in the ten years period the salt affected land was increased to 0.35 per cent of this district. In 2010 the plantation land was found to be 198.56 sq.km. In 2010 compared to 1990 the salt affected land was increased to 0.15 per cent. Over all changes in land was 0.90 per cent.

### **Tanks**

In 1990 tanks area was occupied an area of 17.94 sq.km and the same in 2000 and 2010 also. So, there is no change in the tanks land cover. It was noticed in the blocks are Nagapattinam, Keelaiyur, Kilvelur, Kollidam, Kuthalam, Mayiladuthurai, Sirkazhi, Sembanarkoil, Thalainayiru, Thirumarugal and Vedaranyam. In this type of water bodies like tanks and its water resources are mostly depends upon from various types of rivers of this district.

### **Suggestion**

1. Nagapattinam district is a plain with coastal land in nature. Most of the blocks are having agricultural activities. The land use and land cover entirely changing due to terrain and climatic conditions of the study area.

2. Nagapattinam district is agriculture and fishing self-sufficient area, it has humble agricultural lands. So, a proper consideration to this sector is needed. Best seed selection, micro nutrients, proper pesticides and insecticides and disease management should be upgraded. There is a very great and adequate scope for developing marketing infrastructure.
3. Since Nagapattinam district is a coastal area. So, fishing and its marketing is also one of the major activities of this district. If a proper transportation and storage facilities are provided in this Nagapattinam district will prove to be a very great commercial center for marine products.
4. Nagapattinam district is a big marketing center for horticulture products with vegetables growing and agricultural products etc., but, due to lack of processing packaging and export infrastructure facilities are not shown in sufficient level. So, necessary steps should be taken in this district.
5. Nagapattinam district has rich Agro-diversity and rich fertile soils are available. But soil fertility is being degraded due to continuous cropping methods, without adequate soil health management practices which should be improved.
6. Many European countries and their cultivation lands are kept undisturbed, for construction of buildings, industries and marketing places. Barren land, fallow land and scrub lands are used for those works. But, in Nagapattinam district agricultural lands are getting converted in to built-up lands. These activities should be restricted immediately.
7. By end of this century it is expected that the lakhs of people will migrate due to climatic changes, lack of rainfall and drought. So, land use should be controlled.